Webology, Volume 1, Number 2, December, 2004

Application of Ranganathan's Laws to the Web

Alireza Noruzi
Department of Information Science, University of Tehran, Iran

Received November 5, 2004; Accepted December 3, 2004

Abstract

This paper analyzes the Web and raises a significant question: "Does the Web save the time of the users?" This question is analyzed in the context of Five Laws of the Web. What do these laws mean? The laws are meant to be elemental, to convey a deep understanding and capture the essential meaning of the World Wide Web. These laws may seem simplistic, but in fact they express a simple, crystal-clear vision of what the Web ought to be. Moreover, we intend to echo the simplicity of Ranganathan's Five Laws of Library Science which inspired them.

Keywords

World Wide Web, Ranganathan's laws, Five Laws of Library Science

---

Introduction

The World Wide Web is an Internet system that distributes graphical, hyperlinked information, based on the hypertext transfer protocol (HTTP). The Web is the global hypertext system providing access to documents written in a script called Hypertext Markup Language (HTML) that allows its contents to be interlinked, locally and remotely. The Web was designed in 1989 by Tim Berners-Lee at the European Organization for Nuclear Research (CERN) in Geneva (Noruzi, 2004).

We live in exciting times. The Web, whose history spans a mere dozen years, will surely figure amongst the most influential and important technologies of this new century. The information revolution not only supplies the technological horsepower that drives the Web, but fuels an unprecedented demand for storing, organizing, disseminating, and accessing information. If information is the currency of the knowledge-based economy, the Web will be the bank where it is invested. It is a very powerful added value of the Web that users can access resources online electronically, that for whatever reason are not in the traditional paper-based collections. The Web provides materials and makes them online accessible, so they can be used. This is the real difference between the Web and libraries. Therefore, webmasters build web collections not for vanity but for use.

The Web is interested in its cybercitizens (users) using its resources for all sorts of reasons: education, creative recreation, social justice, democratic freedoms, improvement of the economy and business, support for literacy, life long learning, cultural enrichment, etc. The outcome of this use is the betterment of the individual and the community in which we live -the social, cultural, economic and environmental well being of our world. So the Web must recognize and meet the information needs of the users, and provide broad-based services.

The Five Laws of Library Science

Shiyali Ramamrita Ranganathan (1892-1972) was considered the father of Library Science in India. He developed what has been widely accepted as the definitive statement of ideal library service. His *Five Laws of Library Science* (1931) is a classic of library science literature, as fresh today as it was in 1931. These brief statements remain as valid -in substance if not in expression- today as when they were promulgated, concisely representing the ideal service and organizational philosophy of most libraries today:

1. *Books are for use.*
2. *Every reader his or her book.*
3. *Every book its reader.*
4. *Save the time of the reader.*
5. *The Library is a growing organism.*

Although these statements might seem self-evident today, they certainly were not to librarians in the early part of the 20th century. The democratic library tradition we currently enjoy had arisen in America and England only in the latter part of the nineteenth century (Sayers, 1957). For Ranganathan and his followers, the five laws were a first step toward putting library work on a scientific basis, providing general principles from which all library practices could be deduced (Garfield, 1984).

In 1992, James R. Rettig posited a Sixth Law, an extension of Ranganathan's laws. He conceived that Sixth Law "*Every reader his freedom*" as applicable only to the type of service (i.e., instruction or provision of information).

New information and communication technologies suggest that the scope of Ranganathan's laws may appropriately be extended to the Web. Nowadays the same five laws are discussed and reused in many different contexts. Since 1992, the 100th anniversary of Ranganathan's birth, several modern scholars of library science have attempted to update his five laws, or they reworded them for other purposes.

'Book, reader, and library' are the basic elements of Ranganathan's laws. Even if we replace these keywords with other elements, Ranganathan's laws still work very well. Based on Ranganathan's laws, several researchers have presented different principles and laws. For instance, "*Five new laws of librarianship*" by Michael Gorman (1995); "*Principles of distance education*" by Sanjaya Mishra (1998);

"*Five laws of the software library*" by Mentor Cana (2003); "*Five laws of children's librarianship*" by Virginia A. Walter (2004); "*Five laws of web connectivity*" by Lennart Björneborn (2004); and "*Five laws of diversity/affirmative action*" by Tracie D. Hall (2004).

Gorman's laws are the most famous. He has reinterpreted Ranganathan's laws in the context of today's library and its likely future. Michael Gorman has given us his five new laws of librarianship:

1. *Libraries serve humanity*.
2. *Respect all forms by which knowledge is communicated*.
3. *Use technology intelligently to enhance service.*
4. *Protect free access to knowledge; and*
5. *Honor the past and create the future* (Crawford & Gorman, 1995).

Gorman (1998a,b) believes that S.R. Ranganathan invented the term 'Library Science' and beautifully demonstrates how his laws are applicable to the future issues and challenges that librarians will face. Gorman's laws are not a revision of Ranganathan's laws, but another completely separate set, from the point of view of a librarian practicing in a technological society (Middleton, 1999).
Furthermore, based on Ranganathan's laws, Jim Thompson (1992) in protesting against a library services, revised Ranganathan's laws to the following statements:

1. *Books are for profit.*
2. *Every reader his bill.*
3. *Every copy its bill.*
4. *Take the cash of the reader.*
5. *The library is a groaning organism.*

Whether one looks to Ranganathan's original *Five Laws of Library Science* or to any one of the many new interpretations of them, one central idea is immediately clear: Libraries and the Web exist to serve people's information needs.

The Five Laws of the Web

The *Five Laws of the Web* are inspired by the "*Five Laws of Library Science*" which were the seed of all of Ranganathan's practice. These laws form the foundation for the Web by defining its minimum requirements. While the laws seem simple on first reading, think about some of the conversations on the Web and how neatly these laws summarize much of what the Web community believes. Although they are simply stated, the laws are nevertheless deep and flexible. These laws are:

1. *Web resources are for use.*
2. *Every user his or her web resource.*
3. *Every web resource its user.*
4. *Save the time of the user.*
5. *The Web is a growing organism.*

The Web consists of contributions from anyone who wishes to contribute, and the quality of information or the value of knowledge is opaque, due to the lack of any kind of peer reviewing. Moreover, the Web is an unstructured and highly complex

conglomerate of all types of information carriers produced by all kinds of people and searched by all kinds of users (Björneborn & Ingwersen, 2001).

This new revised version of Ranganathan's laws gives us the grounding for librarians' profession just as the 193l original did. The Web exists to help users achieve success through serving user information needs in support of the world community. Information needs are met through web pages and documents appropriate to web users. In fact, the *Five Laws of the Web* are really the foundations for any web user-friendly information system. What they require is universal access as a right of cybercitizenship in the information age. Like most laws, they look simple until you think about them. We explain each law here:

1. Web resources are for use

The Web was designed to meet the human need to share information resources, knowledge, and experience. Webmasters want people to interact with their web sites and pages, click on them, read them, print them if they need to, and have fun. So web sites are not statues or temples users admire from a distance. This law implies that the Web is for using and learning and information is there to be used. This law is very important because information serves no purpose if it is not utilized and at least available for people to attempt to learn. The role of the Web is to serve the individual, community and service, and to maximize social utility in the communication process.

The dominant ethic of the Web is service to society in general. The question "how will this change improve the service that the Web gives better? " is a very effective analytical tool. Another aspect of this law is its emphasis on a mission of use both by the individual seeker of truth and for the wider goals and aspirations of society. So "information is for use and should not be hidden or altered from people" (Middleton, 1999).

The Web is central to freedom, intellectual, social, and political. A truly free society without the Web freely available to all is an oxymoron. A society that censored the Web is a society open to tyranny. For this reason, the Web must contain and preserve all records of all societies, communities and languages and make these records available to all. We should put the emphasis on free access to information. Old web pages should be protected by Internet Archive (www.archive.org) and national libraries for future users. The Web of the future must be one that retains not only the best of the past but also a sense of the history of the Web and of scholarly communication.

The Web must acquire materials and make them accessible so they can be used. The Web needs to be accessible to users. A webmaster who has faith in this law is happy only when the users read and use his web pages. As some webmasters are currently closing their files by password-protected systems, and others charging fees and introducing fines, law one admonishes: *Web resources are for use*.

What we are producing and delivering via the Web and how well we are doing that, are the tangible results of the Web. So what is best practice now and what does this indicate for the future of the Web?

Just as Newton's first law of motion ("A body at rest remains at rest unless acted upon by an outside force") is a statement of the obvious, the first law of the Web also puts forth an obvious and elemental principle. But even so, it is a law that is often violated in the practice and use of the Web. Medieval and monastic libraries, as an extreme example, were chained books to the shelves. The books literally were attached to the shelves with brass chains and could only be used in a single location. Obviously, this was done primarily for preservation of the books rather than to facilitate their use. On the other hand, it might be argued that this method of controlling access helped prevent theft and thereby facilitated use!

But you don't have to go all the way back to medieval times to find ways by which librarians can obstruct the use of library materials. Limiting access to books and information resources has prevailed through time, and exists even today. Maintaining special web collections with limited access; storing materials off-site; restricting access to web resources based on memberships, fees, or even by selecting materials that are contracted in such a way as to limit use to particular classes of users (such as when a public library, or a library that is open to the public, eliminates print resources in favor of an electronic version of the material that is only accessible to certain users with passwords) are all modern equivalents of chaining books to the shelves (Leiter, 2003). And all bring into question whether the Web is adhering to the first law: *Web resources are for use.*

Another aspect of this first law is that either the Web is about service or it is about nothing. In order to deliver and reap the rewards of services, the Web must identify the benefits that society can reasonably expect and then devise means of delivering those benefits. Service always has a purpose and of course, price, and the Web has a purpose. If web resources are for use, what happens to unused resources?

The Web relies on user-orientation to justify and develop the Web operations. Suominen (2002) called this 'userism'. At the outset, let us distinguish between good and valuable user-orientation on the one hand, and naive, biased and ideological userism on the other hand. One can speak of the latter when users' interests are assumed, self-evidently, as the only possible rationale for the Web operations, to the extent that no other rationales are even considered. This can be illustrated by a simple example. There is something particularly convincing in the claim that

1. The Web exists for users. Therefore, the interests of users must be the basis of the Web operations;
2. The Web exists for researchers and writers, so the interests of researchers and writers should be central in the Web policies;
3. The Web exists for society, and it should serve the interests of society.

It can be argued that these three assertions are not mutually exclusive, for surely the interests of society are those of the cybercitizens, so claims 1 and 2 are included in claim 3.

Furthermore, one might assume that these three different categories are collective that individual interests reduce to collective interests by way of the collective culture contributing to the creation of individuals, 'culture speaks in us' (Suominen, 2002).

This law dictates the development of systems that accommodate the use of web resources. For instance, updating and regular indexing of web site resources facilitates the use of site resources and the Web in general.

2. Every user his or her web resource

This law has many important implications for the Web. This law reveals the fundamental need for balance between making web resources and the basic right of all users to have access to the web resources they need anywhere in the world. This makes diffusion and dissemination very important; each web resource should call to mind a potential user.

A web site must formulate access policies that ensure that the collection it is building and maintaining is appropriate and adequate to fulfill the expectations of its community of users. In other words, the collection must be appropriate to the web site's mission. A web site must contain resources appropriate to the needs of *all* its users. Any web site that limits access in any way must ensure that this restriction does not prevent adequate access to the collection by the users that web site was created to serve. Access policies also have implications for search engines.

However, there is an even more practical aspect to this law. Webmasters must know their users well if they are to provide them with the materials they need for their research or that they wish to read. A responsibility, therefore, of any webmaster is to instruct and guide users in the process of search for web documents they need for enjoyment, education or research. Clearly, it is the business of webmasters to know the user, to know the web resources, to actively help in the finding and retrieving by every user of his or her web resource, and to help search engines in the process of indexing web sites. Webmasters need to ask themselves:

- Who might want to access information resources?
- Who will or won't have access?
- What are the issues surrounding access to printing, passwords, etc. ?

Webmasters must acknowledge that users of web sites, themselves included, use and value different means of communications in the pursuit of knowledge, information and entertainment. Web sites must value all means of preserving and communicating the records and achievements of the human mind and heart. This second law dictates that the Web serves all users, regardless of social class, sex, age,

ethnic group, religion, or any other factor. Every cybercitizen has a right to information. Webmasters and search engine designers should do their best to meet cybercitizens' needs.

3. Every web resource its user

When a web user searches the Web, or gains access to the Web's services, there are certain web resources that will meet his or her needs. It is webmasters' job to ensure that the connection between the user and the web resources is made and that connection is as practical, easy and speedy as possible. Appropriate arrangement of documents in a web site is also an important means of achieving this objective of the third law.

If a web resource is secretly published by a web site, but its diffusion and dissemination otherwise kept secret, the web resource may not be readily discovered and retrieved until the user has reached a crisis in his or her research. At such a time, a frustrated user may seek out a webmaster or someone else with knowledge of the needed web resource's existence, or may simply stumble upon it by serendipity. While either scenario may represent a happy ending for the user, they are not the preferred model of web service. And in the worst case, the web resource may remain invisible indefinitely.

How can a webmaster find a user for every web resource? There are many ways in which a web site can actively work to connect its resources to its users:

- Distribution of new web resources via mailing lists, listservs and discussion groups;
- Making new web resource list on the home page of the site, etc.;
- Submitting resources to popular search engines and directories, which is the most common way of indexing the new resources of a web site.

The use of a structured, well-organized and more categorized site map/index is a necessity, as it ensures uniformity of treatment of various web resources on similar topics. It should be simple, and easy to use. This is something most webmasters probably feel that they already do, but their site maps are not always clear and easy to use. Also important is a correct link to web resource, as mislinking and misindexing a resource can make it all but invisible to the user and, for all practical purposes, lost. To help users to find resources that are topically related, web site designers should use navigational links.

The point here is that webmasters should add content with specific user needs in mind, and they should make sure that users can find the content they need easily. They should make certain that their content is something their users have identified as a need, and at the same time make sure they do not clutter up their web site with content no one seems to care about (Steckel, 2002). Webmasters need to continue adding unique content to their web sites, because the high quality content is everything.

This third law is the most sensible, and it is consistently broken by most webmasters and web writers on most subjects. This law stipulates that a web resource exists for every user, and that resource should be well described and indexed in the search engines' indexes, displayed in an attractive manner on the site, and made readily available to users. This law leads naturally to such practices as open access rather than closed files, a coherent site arrangement, an adequate site map, and a search engine for each site. "It should be easy for users to search for information from any page on a site. Every page should include a search box or at least a link to a search page" (Google, 2003).

4. Save the time of the user

This law presents the biggest challenge to the Web administrators, webmasters and search engine designers. Webmasters should always bear in mind that the time of users is very important and precious. A web site must always formulate policies with the information needs of its users in mind. Web site collection must be designed and arranged in an inviting, obvious, and clear way so as not to waste the time of users as they search for web resources they need.

This law has both a front-end component (make sure people quickly find what they are looking for) and a back-end component (make sure our data is structured in a way that information can be retrieved quickly). It is also imperative that we understand what goals our users are trying to achieve on our site (Steckel, 2002).

Webmasters have helped save the time of the user by creating a user friendly web site. When a site has been finished, uploaded and tested with users, their experiences will be worth reading. Perhaps then, the question is that "is the web site user-friendly?" A webmaster should think about users and how to attract them, develop for them, cater to them, if s/he wants to satisfy the Web community. We need to remember that the webmasters' job is to help web users research effectively and efficiently, to update web sites, and to make them easy to navigate. So user friendliness and usefulness are important.

Perhaps this law is not so self-evident as the others. None the less, it has been responsible for many reforms in web site administration. A web site must examine every aspect of its policies, rules, and systems with the one simple criterion that saving the time of the user is vital to the web site's mission.

There are other ways to satisfy this law. A well-planned and executed site map saves the time of the user. Saving the time of the user means providing efficient, thorough access to web resources. It means satisfied web users. This is the prime measure of the web site's success; disappointed or frustrated users mean that web site has failed in its duty and its responsibility. This law might be restated as: *Serve the user well*.

In order to save the time of the user, web sites need to effectively and efficiently design systems that will enable the users to find what they are looking for quickly and accurately, as well as to explore the vast amount of collection of information available that could potentially be useful. This fourth law emphasizes efficient service to the users, which implies a well design and easy-to-understand map/index to the site.

5. The Web is a growing organism

The Web reflects the changes in our world and will continue to grow as we move along in life and contribute to its riches. It is indeed a growing organism. We need to plan and build with the expectation that the Web and its users will grow and change over time. Similarly we need to keep our own skill levels moving forward (Steckel, 2002).

The Web presents an interesting dilemma for librarians. For while only about 50,000 books are published each year in the United States, the World Wide Web contains an ever-growing and changing pool of about 320 million web pages. When a book is published, it has been assessed by editors and publishers, and hopefully has some value. Moreover, when a web page is published, it has simply been uploaded to a server somewhere. There are no guidelines for the Web. Anyone can publish--and does. Librarians can play an important role in weeding through the dross and establishing annotated lists of links that patrons can feel confident about using. The boundless resources found on the Web benefit from a librarian's expertise in such areas as indexing and cataloguing, as well as search techniques; there will be an increased demand for these types of skills as users demand more value from the searches that they conduct (Syracuse University, 2004).

Today, the Google index of the Web contains over 8 billion web pages (Google, 2004) and the Web is growing at a rapid rate, providing a huge source of information for users and a huge potential client base for businesses who have a web presence (Thelwall, 2000). The Internet Archive is building a digital library of web sites and other cultural artifacts in digital form. Like a paper library, it provides free access to researchers, historians, scholars, and the general public. Its information collection contains 30 billion web pages. Its wayback machine, which currently contains over 100 terabytes of data and is growing at a rate of 12 terabytes per month, is the largest known database in the world, containing multiple copies of the entire publicly available Web (Internet Archive, 2004). For better or for worse, the Web plays an important role in all countries and societies.

The fifth law tells us about the last vital characteristic of the Web and stresses the need for a constant adjustment of our outlook in dealing with it. The Web grows and changes and will do so always. Change and growth go together, and require flexibility in the management of the Web collection, in the use of cyberspace, in the retention and deployment of users, and in the nature of web programs. The Web collection increases and changes, information technologies change and people will

change. So this fifth law recognizes that growth will undoubtedly occur and must be planned for systematically.

Discussion

The *Five Laws of the Web* help to identify the Web as a powerful inspiration for technological, educational and social change. The user is rightly the center of attention in this process. So, it is only through understanding user needs and characteristics that webmasters and search engine designers can build tools to help users meet their information needs. Saving the user's time by providing convenient access mechanisms is a principal concern of the Web. Furthermore, some writers and webmasters like to share their information and knowledge with others through web pages. This is because the Web is for use, and can provide a dynamic source of information for all kinds of users.

The growth of userism in recent Web thinking can be understood partly in relation to the prevailing neo-liberalistic view of society. When human beings are reduced to customers, consumers or users, society can be reduced to a market. A critique of userism is thus topical (Suominen, 2002).

Conclusion

What should we learn from these *Five Laws of the Web*? It is our hope that the reader has gained two things from this essay: first, a new appreciation for the work of the great Indian librarian; second, a renewed perspective on and appreciation of our work as information professionals and librarians. We started this paper with a question "What do these laws mean?". The first four of these reflect the way of thinking that we call userism. According to these laws, the Web's raison d'être lies in its relationship with users and use.

These laws are as applicable to the current practice of the Web as they will be to the Web of tomorrow. These laws are not only applicable to the Web in general but characterize the establishment, enhancement, and evaluation of online databases and digital library services as well. These five laws concisely represent the ideal service and organizational philosophy of the Web. Therefore, we can evaluate web sites by applying the *Five Laws of the Web*.

We end the paper with other questions for future readers. What will the next great age of the Web be? Is the Web as civilizing force or a cause of exclusion? Is it a bastion of intellectual freedom? Is it a vital force for social and cultural cohesion? Whatever it is now, it will assume to the essential roles libraries have had throughout the ages.

Acknowledgements

The author wishes to thank Mrs. Marjorie Sweetko for her helpful comments.

References

- Berners-Lee, T. (1989, September 24). *Information management: a proposal*. CERN, March 1989, May 1990. Retrieved September 2, 2004, from http://www.w3.org/History/1989/proposal.html
- Björneborn, L. (2004). *Small-world link structures across an academic web space: a library and information science approach*. Ph.D. Thesis. Royal School of Library and Information Science, Copenhagen, Denmark.p.245-246.
- Björneborn, L., & Ingwersen, P. (2001). Perspectives of webometrics. *Scientometrics* , 50 (1), 65-82.
- Cana, M. (2003, July 5). Open source and Ranganathan's five laws of library science. Retrieved October 22, 2004, from http://www.kmentor.com/socio-tech-info/archives/000079.html
- Crawford, W., & Gorman, M. (1995). *Future libraries: dreams, madness & reality*. Chicago and London, American Library Association.
- Garfield, E. (1984). A tribute to S.R. Ranganathan, the father of Indian Library Science. Part 1.Life and Works.*Current Contents*, 6, February 6,5-12.
- Google (2003). 10 Tips for enterprise search: a best practices tip sheet. Retrieved October 15, 2004, from http://www.google.com/appliance/pdf/google_10_tips.pdf
- Google (2004, November 15). Google's index nearly doubles. Retrieved November 15, 2004, from http://www.google.com/googleblog/
- Gorman, M. (1995). Five new laws of librarianship. *American Libraries*, 26 (8), 784-785.
- Gorman, M. (1998a). *Our singular strengths: mediations for librarians*. Chicago, IL: American Library Association.
- Gorman, M. (1998b). The five laws of library science: then & now. *School Library Journal*, 44 (7), 20-23.
- Hall, T.D. (2004). Making the starting line-up: best practices for placing diversity at the center of your library. *2004 National Diversity in Libraries Conference*" *Diversity in Libraries Making It Real*". May, 4-5, Atlanta, Georgia. Retrieved October 15, 2004, from http://www.librarydiversity.org/MakingtheStartingLine.pdf
- Internet Archive (2004). Web Archive. Retrieved October 15, 2004, from http://www.bibalex.org/english/initiatives/internetarchive/web.htm and http://www.archive.org/web/web.php
- Leiter, R.A. (2003). Reflections on Ranganathan's five laws of library science. *Law Library Journal*, 95 (3), 411-418.
- Middleton, T. (1999, October 14). The five laws of librarianship. Retrieved October 15, 2004, from http://www2.hawaii.edu/~trishami/610a.html
- Mishra, S. (1998, October 12). Principles of distance education. Retrieved October 15, 2004, from http://hub.col.org/1998/cc98/0051.html
- Noruzi, A. (2004). Introduction to Webology. *Webology*, 1(1). Article 1. Retrieved October 5, 2004, from http://www.webology.ir/2004/v1n1/a1.html
- Ranganathan, S.R. (1931). *The five laws of library science*. Madras: Madras Library Association.

- Rettig, J.R. (1992). Self-determining information seekers. *RQ*, 32 (2), winter, 158-63. Retrieved October 11, 2004, from http://archive.ala.org/rusa/forums/rettig.pdf
- Sayers, W.C.B. (1957). Introduction to the first edition, (Ranganathan, S.R.) *The five laws of library science*. London: Blunt and Sons Ltd., p. 13-17.
- Steckel, M. (2002). Ranganathan for information architects. *Boxes and Arrows*, 7 October. Retrieved October 20, 2004, from http://www.boxesandarrows.com/archives/ranganathan_for_ias.php
- Suominen, V. (2002). User interests as the rationale of library operations: a critique. *Public Library Quarterly*, 35 (2). Retrieved October 15, 2004, from http://www.splq.info/issues/vol35_2/07.htm
- Syracuse University, School of Information Studies (2004). *Librarians in the 21st century: libraries and the Internet*. Retrieved October 19, 2004, from http://iststudents.syr.edu/~project21cent/
- Thompson, J. (1992). The five laws of library science. *Newsletter on Serials Pricing Issues*, 47, September 13. Retrieved October 12, 2004, from http://www.lib.unc.edu/prices/1992/PRIC47.HTML#47.3
- Thelwall, M. (2000). Who is using the .co.uk domain? Professional and media adoption of the Web. *International Journal of Information Management*, 20 (6), 441-453.
- Walter, V.A. (2001). *Children and libraries: getting it right*. Chicago: American Library Association.

Bibliographic information of this paper for citing:

Noruzi, A. (2004). "Application of Ranganathan's Laws to the Web." *Webology*, **1**(2), Article 8. Available at: http://www.webology.ir/2004/v1n2/a8.html

- Noruzi, A. (2005). Aplicação das Leis de Ranganathan na Web. *ExtraLibris*, 2. Translated into Brazilian Portuguese by Moreno Barros. Available at: http://www.extralibris.info/arquivos/2005/03/aplicacao_das_l.html
- Noruzi, A. (2005). Application of Ranganathan's Laws to the Web. Translated into Persian by Fatemeh Amouhosseini & Tahereh Aziminia. *Iranian Journal of Information Science*, forthcoming. http://www4.irandoc.ac.ir/jrnl-all.htm