

THE DIGITAL LIBRARY OF BABEL OR THE ART OF HANDLING KNOWLEDGE RESOURCES ON WEB 2.0

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Abstract

Web 2.0 has introduced a paradigm shift in handling with information closely connected with the acquisition of knowledge. Theoretically, everybody has open access to a wide range of information and, at the same time, everybody has a chance to contribute content while placing web sites or other documents in the Web. This democratization of knowledge, however, is not entirely free of controversy. The coexistence of factually correct and trivial information alerts the opponents. They detect an information overload and fear the demise of classical education.

How is it possible to locate high-quality web sites in the overabundance of web resources? What's the contribution that social software can provide in this context? What makes web sites reliable and trustworthy sources of information? The main goal of this paper is to develop strategies for handling knowledge resources on the web considering theoretical and practical implications. The main focus is to discuss the application of evaluation methods and to demonstrate how social software, e.g. social bookmarking or social tagging, supports the search process and helps to find web sites with qualitative and trustworthy information.

Keywords - Information research, web site evaluation, social software.

1 INTRODUCTION

The short story "The Library of Babel" by the Argentine author and librarian Jorge Luis Borges describes a universe in the form of a vast library containing all possible books. Exploring the connections between the decentralized Internet of YouTube, blogs and Wikipedia, the so-called Web 2.0, and Borges's stories, which "make the reader an active participant" [1], Sassón-Henry describes Borges as "from the Old World with a futuristic vision" [1]. In her interdisciplinary literature study she analyses Borges's innovative ideas about reading, writing, the role of the author, the role of the reader, and shows how Borges anticipates hypertext and Internet: "In 'The Library of Babel', Borges portrays man's inability to find the infinite and perfect book. Thus, Borges seems to prophesy the predicament of those in the twenty-first century who attempt to find all the answers to their problems in the Internet. From this perspective, Borges's 'The Library of Babel', representing the limitations of printing, may be read today as a warning about the limitations of hypermedia systems" [1].

The center of Borges's library such as that of the World Wide Web can be seen anywhere or nowhere, which does nothing to the cause. Of particular importance is, actually, not whether the center is found or not, but the traveled way and the ideas developed during reading. This search for meaning in the library as in the virtual space makes route worthwhile. It is the readers' turn, because they have the task to add importance to what to them appears as chaos.

"Knowledge is about knowing where to find out the things you do not know", based on the use of free knowledge resources these words of the German sociologist and philosopher Georg Simmel (1858 - 1918) refer to the general assumption that the Internet is, as it were, a palladium of the whole knowledge of mankind, like a universal library, which offers a suitable answer to any question. Apart from the fact that lexical knowledge is relatively easy to find on the web, of course, the question remains, what really has to be known by a user for locating certain web information, for evaluating, and inter-

preting it, i.e. for transferring it to knowledge which later can be used within the correct context. We may possess lexical knowledge, but wherever it refers to meaning, relevance and relationships, this knowledge is not enough, then the mere paths of options are too little [2].

Based on the fundamental question how to separate the wheat from the chaff, i.e. how to separate unreliable from reliable websites, Simmel's words get an increasing importance, particularly in Open Access, Open Content, and especially in the Open Education Movement: Users have to concern themselves with existing development tools and evaluation procedures that facilitate the locating, conservation and use of knowledge. From this perspective, the quote could be interpreted to mean that the development of Web 2.0 has opened a new distribution channel through which the retrieval of information is immensely easy, so, in fact, it seems to be sufficient to consider the Internet as a medium for tracking any kind of information, but due to the enormous flood of documents a critical evaluation regarding their reliability and quality will be even more difficult.

The established system of printed information, which successfully worked since the 19th Century and which is linked with control mechanisms such as editors, publishers and reviewers, and which stands for scientific reliability, is now considered in competition with a digital information world where are reigning other laws: The relatively stable distribution system, based on an intensive cooperation between the author (documentation of new scientific knowledge), publishing company (process of selection, production and distribution), and library (bibliographical indexing and provision of publications for the public), becomes unstable [3, 4]. Information retrieval and evaluation are now increasingly the responsibility of the user. Whoever wants to make good use of the available information on the web, has to be media and information literate: One has to be able to select, to understand, to evaluate, and, ultimately, to use adequate resources [5].

Very revealing in this context are the results of a study by Deborah Fallows, who explored in her study the use of search engines and satisfaction with online research results of American Internet users. She concludes:

Searching the internet is one of the earliest activities people try when they first start using the internet, and most users quickly feel comfortable with the act of searching. Users paint a very rosy picture of their online search experiences. They feel in control as searchers; nearly all express confidence in their searching skills. They are happy with the results they find; again, nearly all report that they are usually successful in finding what they're looking for. And searchers are very trusting of search engines, the vast majority declaring that search engines are a fair and unbiased source of information. [6]

Accordingly, the American Internet users within this study assess their search expertise as very good and they rely on search engines concerning the retrieval of reliable information sources.

Within this context we can understand why in the Anglo-American language area we can find a variety of specific sites and tutorials that teach students the critical use of sources. A comprehensive overview of Internet and print sources, mailing lists, checklists, sample and hoax websites offers the "Bibliography on evaluating web information" [7], initiated by Nicole Auer. Among all the online tutorials Place et al. [8], members of the Institute for Learning and Research Technology (ILRT), University of Bristol, are outstanding with their web site "Internet Detective". This tutorial was designed especially for "Intute: Virtual Training Suite" [9], a grouping of several British universities which have set themselves the target to develop more than 60 web-based tutorials for supporting universities and schools in the training of their students in dealing with web resources.

The web site "Internet Detective" is designed to help students in higher and further education who want to use the Internet to help with research for coursework and assignments. At the end of the approximately hour-long unit learners should understand the advanced Internet skills required for university and college work. Students should see why information quality is an issue on the web, especially for academic research, learn how to avoid time wasting on Internet searching, scams and hoaxes, get hints and tips that help to critically evaluate the information they find on the Internet, and be warned about plagiarism, copyright and citation.

Within this briefly outlined the background, the following presentation of information research, evaluation, and transformation does neither claim to include all scientifically documented and published analysis and studies nor to evaluate them. The aim is far more modest: The following explanations will be primarily of interest to users who need special tools or hints for dealing with Internet sources.

2 INFORMATION RESEARCH

We may assume that – like any other consultation process – any information researches on the Internet start with the formulation of a reasonably clear question. How the success of a search can be decisively influenced and accelerated by a clearly formulated question – i.e. the knowledge of what is sought –, illustrates an example brought by David Weinberger concerning the organization of a bookstore:

The normal organization of a store works well enough if you come in knowing what you want: Go to the fiction shelf, find the „A“ section conveniently located at the beginning of the alphabetized authors, and locate that copy of *Pride and Prejudice* for your niece. But *discovering* what you want is at least as important as *finding* what you know you want. Our bookstores look like they prefer seekers over browsers because the usual layout works well for people trying to find what they came in for, whereas there are almost as many ways to organize for browsers as there are browsers. An order that works for one interest may not for others – clustering all the books about the Civil War would help the Civil War buffs but would pull *Gone with the Wind* off the shelf where the historical fiction buffs browse. On the other hand, dumping the shelves into a bookstore-sized pile of books would turn browsing into pawing through printed rubble. [10]

With regard to the described advantages and disadvantages the bookshop in Weinberg's example refers to the differing structure of information spaces: Concerning the provision of information (media), a bookstore or library follows certain rules (alphabetical order according to the author's name), Internet does not behave this way: any user at any time can publish anything, so it is comparable to the giant raised and disorderly pile of books. In both cases, i.e. for searching in a library as well as for searching on the Web, users are more successful and faster when they think in advance about what they want to find. Unlike the search of books in a bookstore or library, where the seekers may even ask sales personnel and librarians for advice and support, due to its chaotic order information retrieval on the web is much more difficult and complex. This also explains why, particularly for researches on the web, it is very important to apply a reasonably well-defined question or a certain search strategy.

In addition to basic considerations, in the following there will be presented some useful Web 2.0 applications and tools that might facilitate any search process on the Internet.

2.1 Research with the Help of Social Bookmarking Sites

It does not seem entirely new, that applying specific questions and research strategies play a crucial role during a research process, as well as in dealing with traditional media and knowledge repositories, such as the search for appropriate literature in print in a public library is usually done following the same pattern: research queries are formulated and strategies are chosen to get more quickly the desired result. Former the results were found on small index cards, to be later used in the preparation of bibliographies, now the bookmark menu of the Internet browser offers the user the opportunity to list the URLs of relevant sites during the research process, what enables the user to come back to them later on. If the list of intensive research activities, however, becomes too extensive the user is able to create different thematic folders into which can be pulled relevant Internet addresses, or the user even can use social bookmarking sites. Their special feature is that the users of such tools have the opportunity to provide relevant Web resources with so-called tags. To identify these relevant resources the users themselves may choose keywords to describe the resource in order to manage and find them easier. David Weinberger describes this system as a "third order of order" [10]. Internet users do not use expert-defined standard classification categories, they use tags and categories generated by themselves:

The keywords added by users are tags. Because tagging is open-ended, tags can be just about any kind of term. They can be descriptions of the resource's subject matter, its location, its intended use, a reminder, or something else entirely. They can be individual words such as "funny" or phrases such as "gift from mom". Different people have different tagging patterns – some people's tags are more expressive, while others are merely descriptive. Tagging systems allow for – and even encourage – these differences. [11]

Tagging web resources becomes very interesting because it is a collaborative and participative process. In this context, we speak of social bookmarking. Social resource sharing systems such as del.icio.us [12], Mister Wong [13] or BibSonomy [14] allow the sharing of bookmarks. Schmitz et al.

[15] regard this as an important approach for collaborative knowledge management. Collaborative classification of Web resources with arbitrary tags, ultimately leads to a relationship network of tags, users and resources. For this network of relations Thomas Vander Wal created the term Folksonomy, a portmanteau word made up of folk and taxonomy. Depending on the number of users who tag a web resource with keywords, he distinguishes between Broad Folksonomy (Fig. 1) - many users provided a resource with different tags (e.g. del.icio.us) - and Narrow Folksonomy (Fig. 2) - a resource is marked by only one user with tags (e.g. a picture on Flickr [16]).

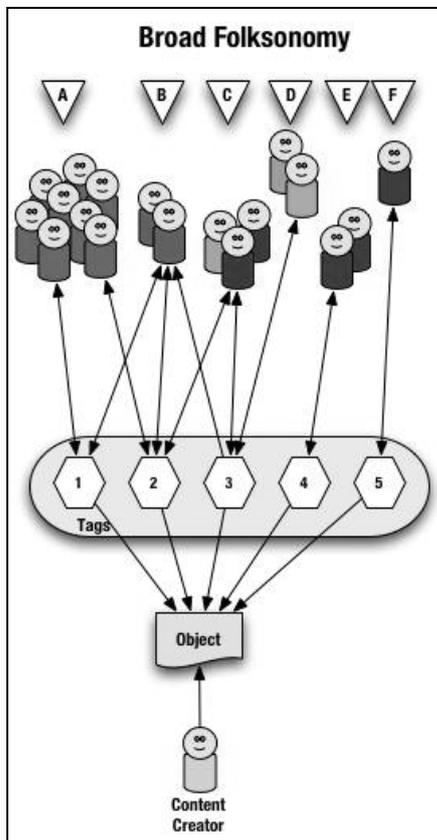


Fig. 1. Broad Folksonomy [17]

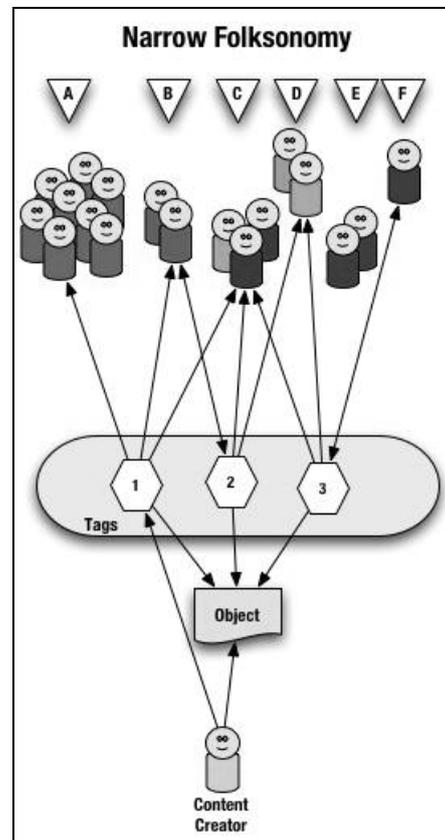


Fig. 2. Narrow Folksonomy [17]

The resulting bookmark lists are generally available to other users. Clicking on a particular tag allows the user to see the latest sites or resources that have been provided by others with it. This facilitates well-directed research on a subject and may provide simultaneously the process of evaluating websites or other useful resources. In this context, the visualization of tags in the form of tag clouds is very valuable: "They can act as navigation, creating an interesting entry point for browsing the resources and users in the system" [11]. The following tag cloud (Fig. 3) demonstrates, for example, which keywords had been used most frequently on BibSonomy:



Fig. 3. Tag Cloud on BibSonomy

As the example shows, the individual words are highlighted in color or in size according to the frequency of their use. The tag clouds on social bookmarking sites provide their viewers with information about popularity or importance of a particular tag. Since every tag is a hyperlink a tag cloud is a perfect navigation instrument or starting point for a Web research.

2.2 Using Social Software Tools for Research Issues

Besides the social bookmarking sites that offer help with individual research and its documentation as well as exchange of references, the Web 2.0 offers to its users a variety of other useful tools that support the research, archiving and writing process. In this paragraph, some tools will be briefly introduced (Table 1), without going into specific details because they are already explained in form of tutorials on the web sites of their providers. The aim is to answer the following questions: What is the tool used for? (A) For whom is the tool? (B) What are the basic functions? (C)

All the mentioned tools are open source products, freely available on the Internet.

Table 1: Useful Web 2.0-Tools

Visualization Tools	A	B	C
FreeMind [18]	brainstorming, mind mapping: suitable for knowledge visualization in the form of mind maps; generation of search queries	students	mind maps provide hyperlinks; allows export to other file formats
CmapTools [19]	knowledge transfer: suitable for linking known and new knowledge, and for the graphic visualization of texts; supports hierarchical visualization of concepts	students and scientists	allows integration of different media and synchronous collaboration; concept maps can be read, i.e. linking two concepts / words forms a sentence; allows export to other file formats
Metasearch Tool	A	B	C
KartOO [20]	web research; visualization of the linking structure of a web site (information visualization)	students and scientists	results are visualized as an interactive and animated map; web sites are visualized as larger or smaller

			leaves, depending on their relevance to the query;
Archiving Tools	A	B	C
Zotero [21]	scientific research; collecting and managing resources (full text, biblio- / webliographical details); archiving of entire web sites (possible annotations in the form of "sticky notes")	students and scientists	add-on for FireFox; storage of source data (main and sub-collections); consideration of different types of sources (podcasts, videos, blog entries, etc.); generation of fully formatted bibliographies; automatically capture of citations; wide variety of import/export options; creation of collections and tags; taking rich-text notes in any language; MS Word / OpenOffice plugins
WebCite® [22]	on-demand archiving system for web references (cited web pages and web sites, or other kinds of Internet-accessible digital objects); archiving of all URLs of an article	students and scientists	allows archiving of web sites during the research process; assigns a reference which contains – in addition to the original live URL (which can and probably will disappear in the future, or its content may change) – a link to an archived copy of the material, exactly as the citing author saw it when he accessed the cited material; enables readers permanent access to the cited material; provides metadata entry (e.g. subject keywords)
LibraryThing [23]	creation of a virtual library; collaborative cataloguing and discussing of books; literature research; scientific research	students and scientists	cataloguing books from Amazon, the Library of Congress and 690 other world libraries; import from anywhere; allows tagging, summarizing, annotations; formation of groups for book discussions; automatically reading recommendations based on the own virtual library;
Translation Tool	A	B	C
LEO [24]	online dictionary; web research: translation of search terms	students and scientists	single-word or phrase search in English, French, Italian, Spanish and Chinese; voice output; vocabulary trainer for individual learning; forum for posting language related discussions

3 INFORMATION EVALUATION

Having a list of search results we have to start the evaluation process. Place et al. [8] summarize this critical approach to web resources with the simple formula: "On the WWW ask WWW: Who? What? Where? [8]" Source (contextualization and evaluation of authorship), content (relationship of the resource content with the user's information-seeking intention) and location (searchability of the web site and the providing institution) of information have to be critically analyzed. The following evaluation model (Fig. 4) is based on scientific approaches Bargheer [25], Katzmayr & Putz [26] and practical tutorials (Place et al. [8], Mohanty et al. [27], Bohren & Magoni Vögtli-Bossart [28] and Rijntjes [29]). It is a user-centered model, i.e. the users themselves have to classify a source as relevant and reliable.

Since the evaluation of a web site should proceed as time-efficient as possible each of these criteria cannot be verified with the same intensity. Bargheer therefore proposes a weighting in four priority levels [25]:

Level 1: obligatory (must be checked, failure is an exclusion criterion)

Level 2: important (should be checked, failure is not an exclusion criterion)

Level 3: recommendable (can be checked, provides important information about quality)

Level 4: subordinated, context-dependent (can be checked additionally, provides indirect information about quality).

In this context it is remarkable that in none of the analyzed tutorials evaluation is considered as a kind of relevance ranking. The individual criteria are presented in a particular order – Bargheer sees this as the "logic of the evaluation process" [25] (content-related criteria are more important than formal) – but not prioritized. Type and complexity of the web site play an important role in the course of an evaluation process. This may require a change to the order of the criteria.

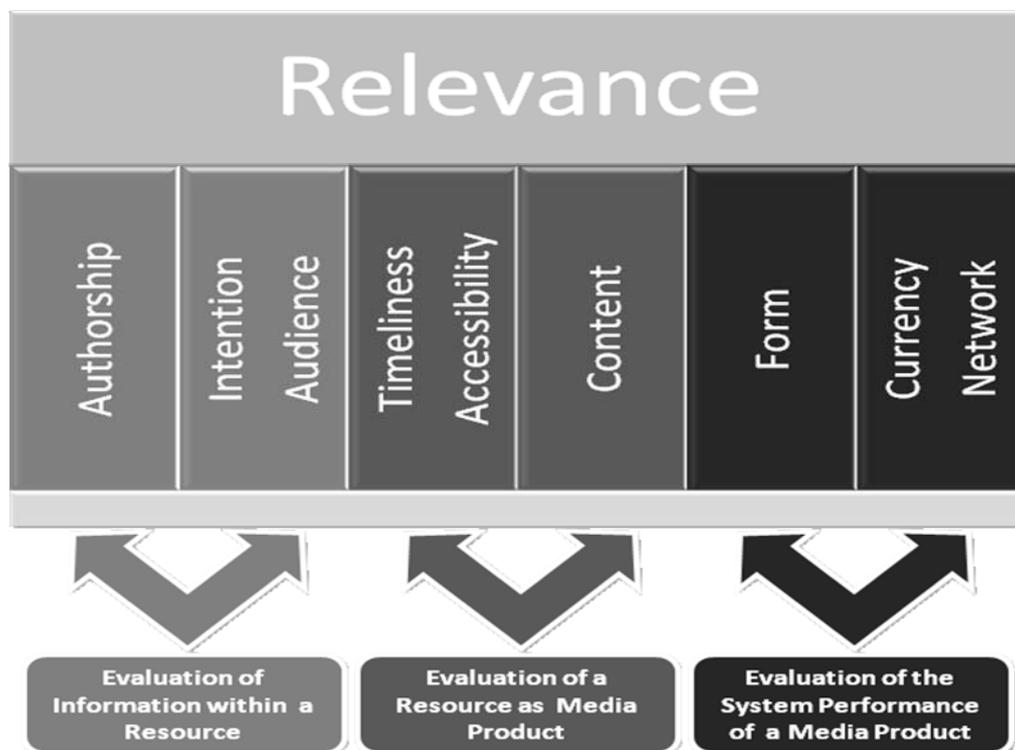


Fig. 4. Evaluation Criteria for Web Sites

3.1 Evaluation of Information within a Resource

Any book provides information about the authors, editors, illustrators, photographers, and the publishers. Normally, we can find this information on the book cover or title page. On web sites, this data is not immediately apparent, unfortunately, they often lack even basic information like an *Impressum*. So

in a first step, we must clarify the identity of the web resource. Of significance are the authorship, the intention and the target audience.

A. Authorship (Priority level 1 or 2)

Especially in educational and scientific contexts, to verify the identity of a web resource is important, because it is a crucial quality criterion. We have to verify who wrote the found web site or who is responsible for its content features. If this data or contact information is missing, a web site has to be excluded.

Where can we find the mentioned details? Important notes about the authors of a web site can be read in the HTML source code. This meta-information can be found in the upper part of the HTML text (header) between <head> and </ head>. For example, the source code of the online tutorial “Internet Detective” reveals Paul Smith as one of the authors (Fig. 5).

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html lang="en" xmlns="http://www.w3.org/1999/xhtml">
<head>
<style type="text/css">
  <!-- @import url(/detective/style/internet_detective_style.css); -->
</style>
<link href="/detective/style/internet_detective_print.css" rel="stylesheet" type="text/css" media="print" />
<meta name="DC.title" lang="en-GB" content="Internet Detective" />
<meta name="DC.creator" content="Paul Smith" />
<meta name="DC.subject" content="" />
<meta name="DC.description" lang="en-GB" content="Internet Detective tutorial, rewritten 2006" />
<meta name="DC.publisher" content="Institute for Learning and Research Technology (ILRT), University of Bristol, UK" />
```

Fig. 5. Header of the Online Tutorial “Internet Detective“

A review of the web address, the Uniform Resource Locator (URL), also allows to draw a conclusion about the authorship. At the same time, the URL syntax informs the user about the type of web site – private, commercial, or organizational – too.

In this context must be noted that there exists the possibility of concealing the true identity of a web site. Bargheer [25] and Katzmayer & Plaster [26] recommend for this purpose the so-called WHOIS queries. Specialized sites help the users to find out who has registered a problematic domain, and how the person or organization may be contacted. The result of a WHOIS query looks like this:

```

WHOIS - webcitation.org

Generated by www.DNSstuff.com

Found WHOIS server for .org: whois.publicinterestregistry.net. Looking up.

NOTICE: Access to .ORG WHOIS information is provided to assist persons in
determining the contents of a domain name registration record in the Public Interest Registry
registry database. The data in this record is provided by Public Interest Registry
for informational purposes only, and Public Interest Registry does not guarantee its
accuracy. This service is intended only for query-based access. You agree
that you will use this data only for lawful purposes and that, under no
circumstances will you use this data to: (a) allow, enable, or otherwise
support the transmission by e-mail, telephone, or facsimile of mass
unsolicited, commercial advertising or solicitations to entities other than
the data recipient's own existing customers; or (b) enable high volume,
automated, electronic processes that send queries or data to the systems of
Registry Operator or any ICANN-Accredited Registrar, except as reasonably
necessary to register domain names or modify existing registrations. All
rights reserved. Public Interest Registry reserves the right to modify these terms at any
time. By submitting this query, you agree to abide by this policy.

Domain ID:D102694176-LROR
Domain Name:WEBCITATION.ORG
Created On:15-Nov-2015
Last Updated On:30-Nov-2015
Expiration Date:15-Nov-2016
Sponsoring Registrar:Public Interest Registry
Status:OK
Registrant ID:tu9ygaaMLWxtb2h
Registrant Name:Gunther Eysenbach
Registrant Organization:Centre for Global eHealth Innovation
Registrant Street1:Toronto General Hospital, 190 Elizabeth Str
Registrant Street2:
Registrant Street3:
Registrant City:Toronto
Registrant State/Province:ON
Registrant Postal Code:M5G2C4

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Fig. 6. WHOIS query for the Domain *webcite.org*

B. Intention and Audience (Priority level 3)

The criterion of intention asks about the motives why a site has been created. Here we have to distinguish whether a site manifests a clear position or whether responds to contradictory interpretations.

The target audience is not insignificant too. Bargheer [25] proposes a possible classification of sites according to their target-group orientation: Useful categories are *popular* (for the vast majority), *under-graduate* (for students), *graduate* (for graduates) and *professional* (for professionals and experts). Especially regarding the relevance analysis this classification comes into play: The users must verify whether the contents of a web resource for them are understandable and usable. The criteria intention and audience, of course, mutually influence each other.

3.2 Evaluation of a Resource as Media Product

The substantive evaluation of a resource, closely linked to its timeliness and accessibility, is based on the different information needs of users. A crucial role is played by the resource itself. Bargheer [25] mentions five main types of resources: *Institutional Sites or Information Providers*, *Factual Reference Work*, *Information Sites or Bibliographic Sources*, *Thematic Sites* and *Primary Information Sites*. The type of category already is an indicator for credibility or authorship. This fact allows the immediate exclusion of a site or a detailed substantive evaluation.

A. Timeliness and Accessibility (Priority level 1 – 2)

Web resources are dynamic and, compared to print-media, are subject to permanent changes. Therefore the determination of the actuality of a web site is a special challenge. The search engines *Google* and *Yahoo!* offer their users a valuable service: If there are interesting links on the hit list of a search, but the original page is unavailable, users can access the cached version from a site. The search engines take a snapshot of each page and cache (store) that version as a back-up.

A special service is offered by the Internet Archive [31]: With the *Wayback Machine* the user can explore the version history of a particular site archived from 1996 to the present.

Beside the timeliness of a web site its availability and accessibility is a further qualitative criterion. The links of a website must be regularly checked to ensure a lasting and sustainable access. This is a fact

In addition to good readability aspects, such as the presence of a full-text search function and a user-friendly navigation structure, affect the ergonomics of the GUI (Graphical User Interface) of a web site. Therefore a (full-text) search function is an indicator for positive quality because due to the lack of pagination it is impossible to reference HTML pages in the correct form.

B. Currency and Network (Priority level 2)

A review of links on a web site can provide information about its reliability. The important thing is to evaluate the linking site too. Very helpful in this context are web directories, public collections of social bookmarks and blogs (such as *Technorati* [33]). Taking advantage of this investigative *tool*, users can critically rely on an annotated pre-selection and / or evaluation of web resources.

4 INFORMATION TRANSFORMATION

After searching and evaluating web resources, the newly acquired information must be integrated into the prior knowledge of the user. This process of knowledge generation, argues Reinmann-Rothmeier [34], may be regarded as the attempt to convert the raw material *information* to applicable knowledge, and in this way, to create new knowledge and produce innovative ideas, alone or together with others.

Based on these considerations, Reinmann [35] links to the Internet. She points out that the quantity of publicly available knowledge was always under the influence of technological developments. For the large increase in public knowledge she sees mainly two reasons: First, Internet can be used as a simple, fast and very economical medium for dissemination of knowledge, and second, Web 2.0 offers the users a variety of easy-to-use technical tools that allow switching the role between consumer and producer. This development does not only call for a certain level of quality concerning user generated content, but facilitates as well access to information for many people, so that an expansion and deepening of their personal knowledge is possible. Merely opening up access and the availability of appropriate media and information literacy, necessary for finding, evaluating, selecting and understanding information, and, finally, for applying it. An active participation in a knowledge society requires personal knowledge and education.

5 CONCLUSION

If the quality of web resources should be critically analyzed, it must be assumed that the (linguistic) signs on the monitor screen only gain importance if the users – they interact with reality, but they deal with things of the reality based on meanings, which construct their own reality – are looking for information on Internet with these constructs. Precondition for the verification of the proposed sources concerning their possible significance or quality are a question or a problem. Knowledge can be understood as a subjective certainty, in which the meaning of information about a topic is focused on a point that allows the development of skills and abilities. Before that is the process of verifying information that can be accomplished in part by applying rules of logic [30].

Fig. 8 illustrates the cyclic course of handling knowledge resources on Web 2.0: The two color-shaded areas show the search process (gray) and the evaluation and transformation process (white) of relevant information. Based on their own constructs (knowledge, cultural background, language, etc.) a user addresses a question, which already includes assumptions and is shaped by its environment, to a knowledge repository (in our case the Internet). The information retrieved will be analyzed and evaluated using the prior knowledge, i.e. applying his reality constructs the user transforms new information into knowledge. In other words: For verification or falsification of a hypothesis or question the user formulates assumptions which are logically derived from the hypothesis or question, and then the user observes whether these assumptions occur or not.

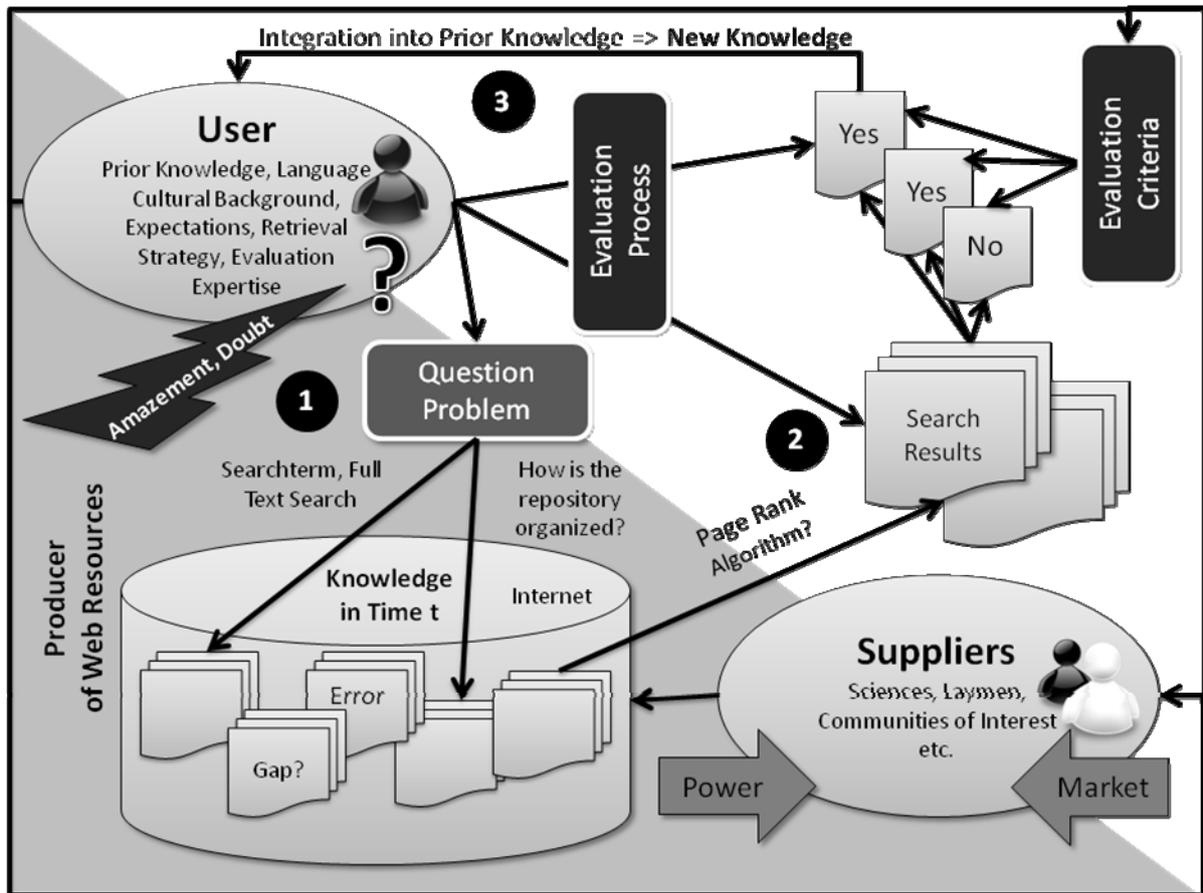


Fig. 8. Cyclic Course of Handling Knowledge Resources on Web 2.0:
Research (1) – Evaluation (2) – Transformation (3)

Viewing the search results we can assume that we will find the same number of useful and useless sources of information. The number of observed cases is always finite, the number of potential cases infinite. The ability to distinguish between high-quality and unimportant web sites depends on the users' worldview. Due to experience and knowledge they are constantly changing their retrieval strategies (e.g. change of assumptions), and they know how to act reasonably in order to get the desired result. The social bookmarking sites, Web 2.0 applications, and evaluation criteria mentioned above can provide this process. The complex handling of knowledge resources on Web 2.0 requires reflection and a very critical attitude toward sources of information. These facts might be useful arguments to dispel the general assumption that Internet and Web 2.0 destroy the concept of classical education.

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