

Quality Models for Websites: Theories and Criteria of Evaluation

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Abstract: *Many approaches to Quality Models for Websites have individualized different characteristics which often make reference to few concepts, as Usability, Content, Navigability, Management and Relationality; these concepts in fact assemble characteristics which probably are not totally independent, and which, though presented with different labels, have similar meanings or recall the same concept. In this work a short survey is introduced about Websites Quality Models: for every Websites Quality Models, the characteristics and their meanings are considered. From the observation of these approaches, it is possible to define an “ideal” Quality Model, to be used as an operative reference, with defined goals and independent, comprehensible, adoptable, and measurable criteria.*

Keywords: *Quality Characteristics, Websites Quality Models*

Introduction:

This work belongs to a research effort aimed at establishing the asset for a service activity of Websites evaluations, to be carried on at the Systems and Software Evaluation Center, IEI – CNR.

Any attempt to evaluate the quality of a Website requires, implicitly or explicitly, a quality model. Regarding to Quality is opportune to distinguish the type of quality we want to refer to, or, following the perspective adopted by the norm ISO/IEC 9126, Internal Quality, External Quality and Quality in use. The type of quality we are interested in a Website, essentially, is the quality perceived by the site’s user, that is the quality in use. The user expectations regarding the information to acquire can be summarized as follows:

- readable and comprehensible
- accessible (i.e. transferable from the Website domain to users’ personal knowledge) despite user’s physical or mental handicap, lower degree of education or old generation browser
- available in brief time and without too many obstacles
- exhaustive and pertinent
- easily traceable
- updated when necessary and opportune
- secure
- able to increase user’s knowledge and open to the exchange of further communication (informations, ideas, opinions...).
- able to provide a service which is explicitly declared within and about the Website

Nevertheless, since the quality positively perceived from the user is hardly achieved without a good intrinsic code quality and good performances, we hold opportune that a quality model shouldn’t disregard to consider both internal and external quality.

For evaluating Websites quality, some approaches found in the big literature repertorium consider general criteria, or criteria adaptable to different kinds of sites, while others are focused on different criteria regarding to different typologies of sites to appraise, such as Public Administration Websites, Cultural Websites, Commercial Websites, medical Information Websites. Rather often, some evaluation criteria are revealed common to quite different Websites; consequently, some Websites Quality Models will be considered regardless of type of site, but having care of underling their differences (that, for some models, are translated in different *weights*).

In the following a short survey of Websites Quality Models, proposed in the last few years, that cover various points of view in observing, gauging and finally evaluating a Website, are summarized. The purpose of this paper is to point out similarities and novelties proposed by any specific quality model and comparing their characteristics.

A short survey of Websites Quality Models

The considered Quality Model are:

- *The sectorial indices*, RUR, Assinform, Censis, 2000 [9]
- *The standard ISO / IEC 9126-1* [2]
- *Website Quality Features*, Ping Zhang and Gisela von Dran, 2001 [12]
- *The pentagon of the quality*, Censis, 2001 [1]
- *Modello 2QCV3Q or 7-loci*, Mich L., Franch M., P. Novi Inverardi, P. Marzani, 2003 [5]
- *Quality Principles for Cultural Websites*, Minerva, 2003 [6]
- *The heptagon of the quality*, IULM, 2004 [3]
- *A Quality Model for Websites*, Roberto Polillo, 2005 [8]
- *A comprehensive Model for Websites Quality*, Oreste Signore, 2005 [10]
- *Evaluating Web Pages*, University of the California "Berkeley", 2006 [11]

RUR, Assinform, Censis, 2000

This investigation on the civic nets and the local telematic services has examined a sample of 356 not chief town centers with population among 5 thousand and 100.000 thousand inhabitants, representative of the over 2.200 mediate – small Municipalities. The Analysis has been focused on some, specific, elements: possession of a Website, content and interactivity of the offer, distribution of the services, technological competence and accessibility of local public Administration internet pages. During investigation came to light six sectorial indices to evaluate according to presence and the articulation of various services: to the indices in fact are associated, overall, 84 control points.

The *sectorial indices* are:

- *Administrative Transparency*, as great transparency in the management of the offices and the administrative procedures
- *Quality of the services*, as not only to photograph the informative dimension but also to work for the affirmation of an interactive dimension of the public services

- *Access and interactivity*, in other words, accessibility of the sites, facility of access to the information, and presence of services and interactive procedures
- *Interactions and relationality*, then to measure the popularity of the sites and to analyze the efforts of the administrations in to build connections and to elaborate projects which are common with other local subjects
- *Territorial marketing*, considering the territory as primary factor of development of the different regional economies which are in competition between them on the basis of the ability to attract resources and investments
- *Technological quality*, as to adjust the increasing demands of renewal and management to the economic and managerial potentialities of the Public Administration in a constant run-up of the innovation put in field by the private subjects.

The standard ISO/IEC 9126, 2001

The norm ISO/IEC 9126 Computer software engineering - Product quality, contains the model of reference to define the characteristics of software quality and the metrics for quality evaluation of the same. Derived by McCall and B. Boehm models of the years '70, the model ISO/IEC 9126, has been defined in 1991 and, subsequently, in phase of issue of the second version, in 2001.

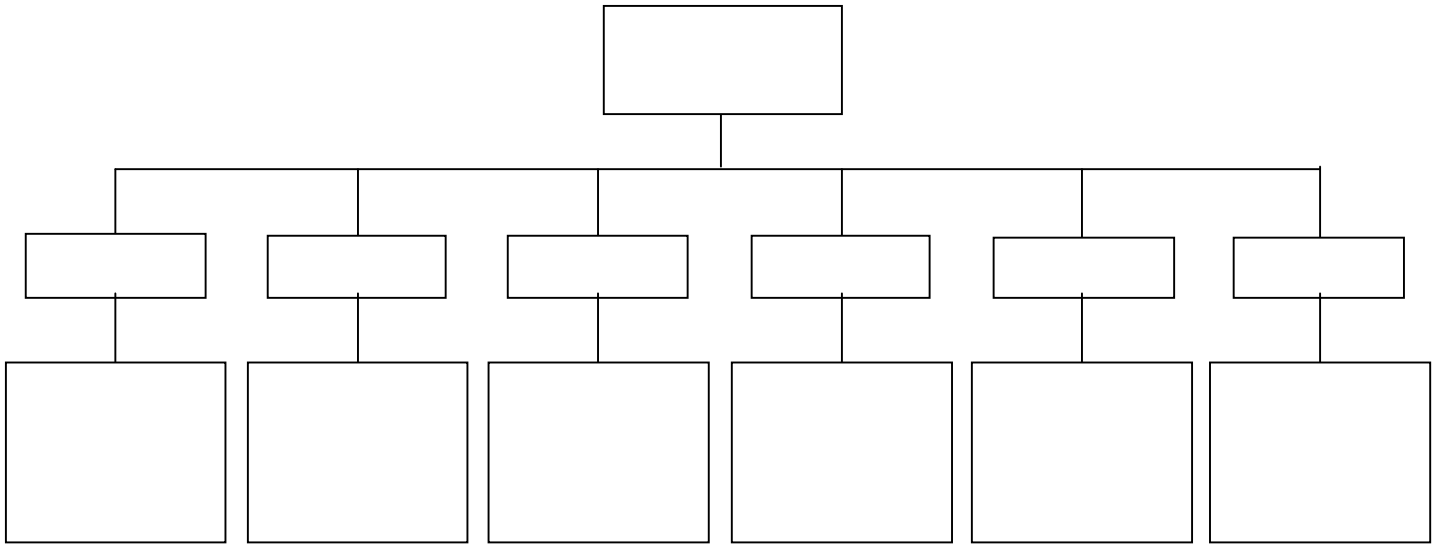
To 2001, the norm is composed by 4 parts:

1. The model of the characteristics and sub-characteristics of software quality (ISO / IEC 9126-1
Computer Software Engineering. Product Quality – Part 1: Quality model, 2001)
2. The metrics for the measure of the external quality (ISO / IEC TR 9126-2, 2003)
3. The metrics for the measure of the internal quality (ISO / IEC TR 9126-3, 2003)
4. The metrics for the measure of the quality in use (ISO / IEC TR 9126-4, 2004)

In order to evaluate the internal quality and the external quality of a software, the standard ISO/IEC 9126-1 defines six main characteristics of quality (abstract) and twenty-seven sub-characteristics. The six characteristics are: *Functionality*, *Reliability*, *Usability*, *Efficiency*, *Maintainability*, *Portability*.

The *Functionality* is the ability to offer such services to satisfy, in established conditions, functional explicit or implicit requisites (the software does that for which it has been programmed); the *Reliability* is the ability to maintain the established performances under the established conditions and the times; the *Usability* is the ability to be understood, learned, used with satisfaction by the user in fixed conditions of use; the *Efficiency* is the relation between performances and quantity of used resources under defined conditions of functionality; the *Maintainability* is the ability to be modified with a contained effort, and, finally, the *Portability* is the facility with which the software can be transferred by an operational environment to another.

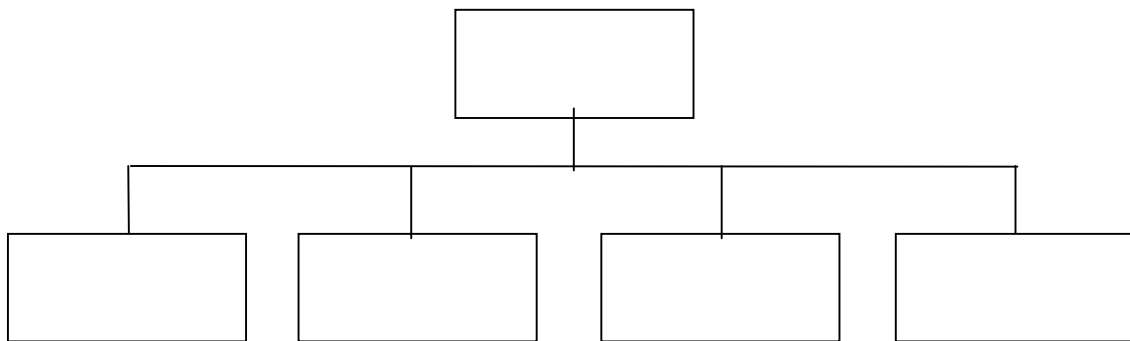
Figure 1 **Characteristics and Sub- Characteristics to evaluate the internal quality and the external quality**



The quality in use evaluation is conducted with reference to 4 characteristics that represent the user’s point of view on the software: *Effectiveness*, *Productivity*, *Safety* and *Satisfaction*.

Effectiveness is the ability to support a user in to achieve his objectives with accuracy and completeness; the *Productivity* is the ability to support a user in to spend the appropriate quantity of resources in relationship to the effectiveness of the results to reach; the *Safety* is the ability to achieve acceptable levels of risk for the people, the environment of use, the activities of the user, and the *Satisfaction* is the ability to satisfy a user in a fixed context of use.

Figure 2 Characteristics and Sub- Characteristics to evaluate the Quality in Use



Ping Zhang and Gisela von Dran, 2001

The objective of this research is to build a theoretical framework for evaluating Website quality from a user satisfaction perspective. To such purpose Ping Zhang and Gisela von Dran have developed a quality model based on Kano's Model, Japanese management consultant and researcher. Kano three levels of customer expectations for product and service quality defined:

- Basic
- Performance
- Exciting

On this structure 2 important variable change the perception of the quality: the time and the imitation by others. The Kano’s Model assumes that with time and imitation by others, exciting

quality features turn into normal expectations, and normal quality features migrate towards basic expectations.

Concurrently with the 3 levels of satisfaction of the customer, the present model hypothesizes that the features of the scheduling of sites web can be define in 3 types of quality that go towards 3 needs of quality:

- Basic Features (they support the expected needs of user; examples are active links and good legibility)
- Performance Features (they contribute to performance quality of the Website; links to related materials and support for different Platforms are examples of performance features)
- Exciting Features (they delights the user and may generate user loyalty; an example of exciting features can be social feedback associated with using the Website)

Defined a list of 74 features in the web environment, for every feature a average score has been calculated; particularly, a different weight is allocated to every different type of quality recognized to the feature: for quality to basic level, weight 1, for quality to performance level, weight 2, for quality to exciting level, weight 3. In order to examine the features from a three quality types perspective, we divide all the features into three groups:

Basic features:

- ✓ Predictability and stability of available information, services, and supportive resources
- ✓ Accurate roadmaps and milestones to provide reality checks
- ✓ Congruency between stated mission and activities or products.

Performance features:

- ✓ They seem dependent on the contexts, purposes, user cultural background, and individual characteristics.
- ✓ They facilitate task performance and will satisfy overtly stated needs of customers.
- ✓ The lack of them will be noticed and disappoint users

Exciting Features:

- ✓ The users acquire new knowledge
- ✓ The users are emotionally involved in a positive way
- ✓ The users have the control of the site
- ✓ The users have trust in the legitimacy of his/her environment web
- ✓ These characteristics surprise, they impress and they delight the user

Censis, 2001

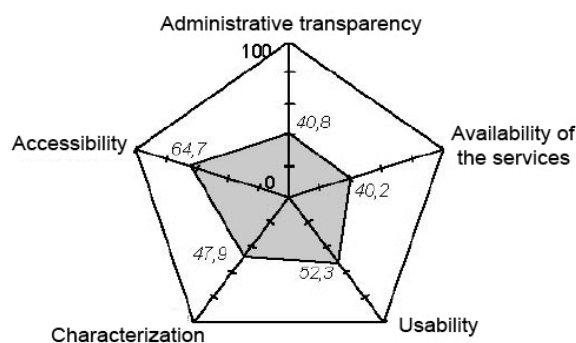
Defined within studies on the Public Administration Websites Evaluation and through the method ARPA (Analysis of the Public Administrations Nets), an analysis of 32 Websites of the Ministries and other Public Corporations to national importance has been carried out, measuring, for everyone, the values of 63 different indicators; such indicators are relating to different aspects and include technical characteristics, functionalities, contents and available services.

The indicators, since they make reference to very different phenomena, are brought back then, through the parametric analysis, to homogeneous values, and from these are drawn the values of five thematic indices that express analytically the characteristics of every Website and of it they measure the value in terms of qualitative correspondence. The thematic indexes to be appraised are:

- ✓ *Accessibility*, meant as the ability of the Website to make own contents and services attainable to all, without dependent barriers from the type of used technology or from the personal abilities.
- ✓ *Usability*, that is facility of navigation and use of the site.
- ✓ *Institutional Characterization*, meant as institutional recognizability of the sites (A site of the public sector should have, beyond the determined characteristics of quality, an aspect that of it makes to perceive its institutional nature immediately, so that the user can recognize of it the nature of official and reliable source)
- ✓ *Administrative Transparency*, meant as application of the sanctioned principles by the laws 142 and 241 of 1990, therefore possibility to publish information in totally automatic way and to make it available to the public in real time, in observance of the privacy.
- ✓ *Availability of the Services*, meant as the possibility to interact directly with the Public Corporation through its Website: a hold integration between informative system and interface Web that allows the administrations to offer innovative services to all the own interlocutors.

To every considered Website is associable a value for everyone of the 5 thematic indices. The whole of such values defines the Website profile, and such profile is graphically express through a polygonal graphics representation: the distance of the vertexes from the center represents the value of every thematic index.

Figure 3 The Pentagon of the Quality



From the average of the 5 thematic indices it is possible to obtain the index ARPAC that determines the total Website quality.

Model 2QCV3Q or 7-loci, 2003

For this approach, in the adoption of a quality model for Website it is necessary to establish the level to which to analyze the characteristics of the site, if therefore to prefer a light model or a heavy model. To such purpose, it is opportune a structure or reference theoretical frame as conceptual

scheme for the quality criteria used in the evaluation. Such structure of reference is the meta-model 2QCV3Q or 7-loci, which takes its name from the initials of the Ciceronian loci of classical rhetoric that it is based on. Through the 7 loci it is possible to identify the main dimensions of a Website, since they constitutes general structure of the quality models, independently from the site under analysis.

The 7 loci or dimensions are:

- *Identity (Who: the image that the organization projects)*
- *Content (What: available information for the users)*
- *Services (Why: services available for the users)*
- *Location (Where: visibility of a site and ability of the site to offer a space where users can communicate with each other and with the organization)*
- *Maintenance (When: all activities that guarantee proper functioning and operability of the site)*
- *Usability (How: it determines how efficiently and effectively the site's content and services are made available to the user)*
- *Feasibility (With what means : includes all aspects related to project management)*

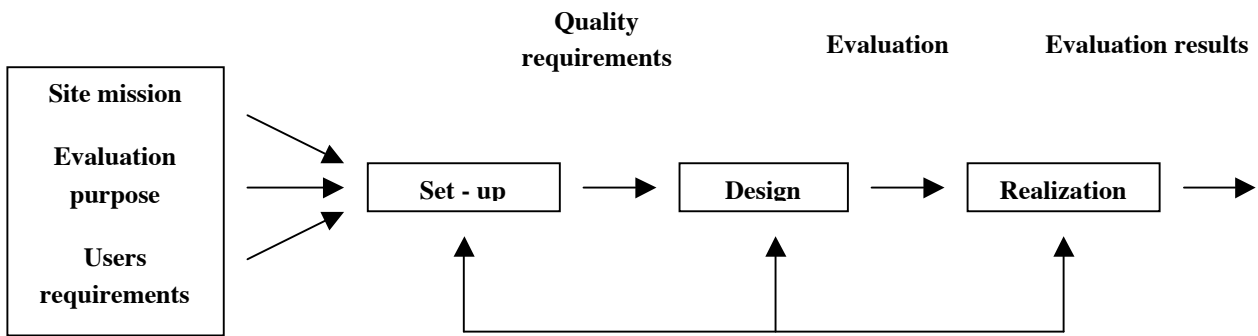
The theorists of this model assert that in the adoption of a quality model for Website it is necessary to establish the level to which to analyze the characteristics of the site, if therefore to prefer a light model or a heavy model. To such purpose, it is opportune a structure or reference theoretical frame as conceptual scheme for the quality criteria used in the evaluation, and such structure of reference is the meta-model 2QCV3Q or 7-loci. Through the 7 loci it is possible to identify the main dimensions of a Website, since they constitutes general structure of the quality models, independently from the site under analysis.

The characteristics of the meta-model are:

- *Scalability*: it is necessary to allow for an evaluation at varying degrees of detail, based on the “evaluation purpose”, the sponsor's requirements and the user's needs.
- *Domain independent* : it is necessary that the meta-model must be applicable in different sectors
- *General purpose*, whether corporate or individual, educational or for the electronic commerce.
- *User-friendly*: to facilitate its comprehension and application by people with different skills.

The model 2QCV3Q or 7-loci can be used, inside of a prototype of evaluation process, in the initial phase (set-up), to support "quality requirements" identification

Figura 4 Quality Evaluation Process



Minerva, 2003

Minerva (Ministerial NETwoRk for Valorising Activities in Digitisation) is another important initiative for Websites quality. The criteria expressed in this model, although generic, mainly refer to cultural Websites, as museums, libraries, archives and other cultural institutions. In this model, quality cultural Website must observe the following criteria:

- ✓ *Transparency* (Reducing user confusion and uncertainty "the sooner possible")
- ✓ *Effectiveness* (The content must be appropriately selected and relevant, valid and correct, accompanied by appropriate commentary and supporting information and the user must be able to easily navigate the site)
- ✓ *Maintenance and update*
- ✓ *Accessibility* (A quality Website must be accessible to all users, irrespective of the technology they use or their disabilities, including navigation, content, and interactive element)
- ✓ *User-centered* (taking into account the needs of users, ensuring relevance and ease of use through responding to evaluation and feedback)
- ✓ *Responsive* (the Website must be allowed the user to contact the site and receive an appropriate reply; where appropriate, it is also opportune to encourage questions and to share information with and among the users)
- ✓ *Multi-lingual* (to provide a minimum level of access in more than one language)

- ✓ *Interoperable* (A quality Website must be committed to being interoperable within cultural networks to enable users to easily locate the content and services that meet their needs)
- ✓ *Managed* (A quality Website must be managed to respect legal issues such as IPR and privacy and clearly state the terms and conditions on which the Website and its contents may be used)
- ✓ *Preserved* (It is required to adopt strategies and standards to ensure that the Website and its content can be preserved for the long-term)

IULM, 2004¹

For this approach, the Website quality model is the *Heptagon of the quality*. The *Heptagon of the quality* considers that the general quality of a Public Administration Website is articulated on three main dimensions and seven factors according to the following scheme:

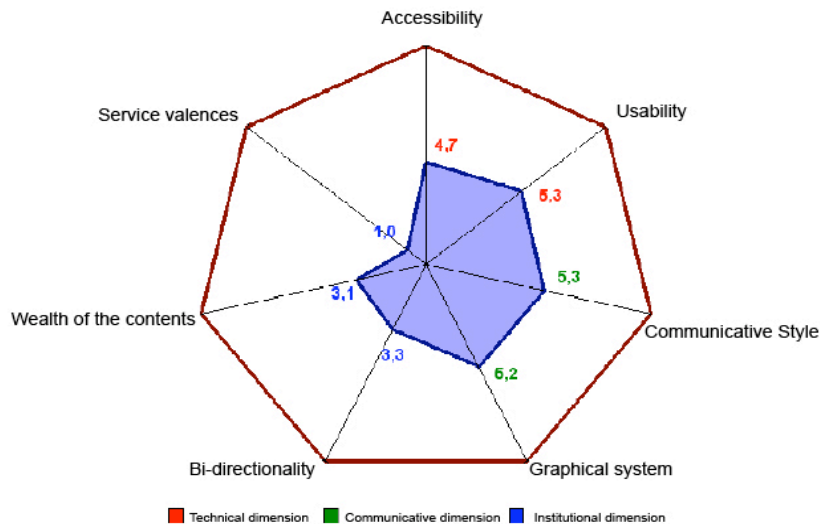
Table 1 **Scheme of Public Administration Website Quality**

DIMENSIONS	FACTORS
Technical dimension	<ul style="list-style-type: none"> • Accessibility • Usability
Communicative dimension	<ul style="list-style-type: none"> • Communicative Style • Graphical System
Institutional dimension	<ul style="list-style-type: none"> • Bi - directionality • Wealth of the Contents • Service Valences

Coming from the measured values on every seven factors, it is possible to build an heptagon having center "0" and, as axes, the value of the weighed indices so that to be able to assume inclusive values among 0 and 10. The heptagon therefore allows to display, graphically, the qualitative level of the considered Websites and the distance between the reached quality and that ideal.

Figure 5 **The Heptagon of the quality: evaluation for the Websites of the Municipalities of the Province of Milan in September, 2003**

¹ This evaluation model has been adjusted by the institute of Communication of the Free University of Languages and Communication Iulm in Milan, in collaboration and on behalf of the Province of Milan, for the Public Administration Websites evaluation.



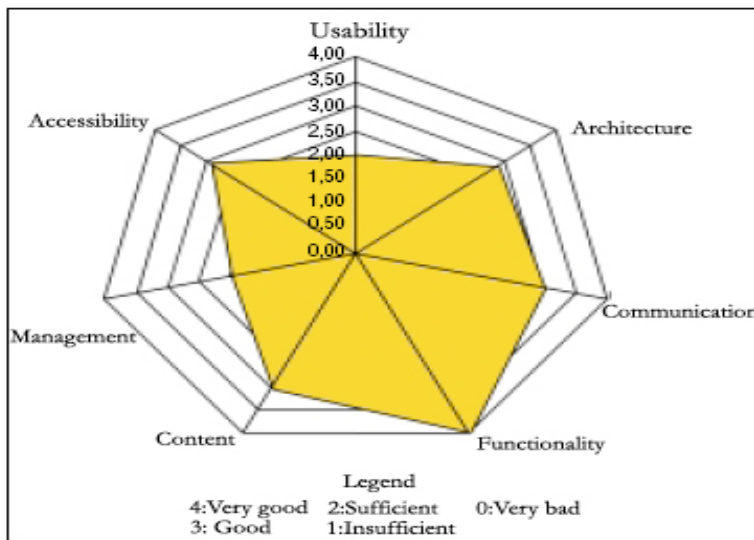
Polillo, 2005

For this approach, to apply the quality model, the definition of the Website's objectives is necessary. The Macro-characteristics regarding which to estimate the Websites quality are:

- ✓ *Informative architecture of the site* (structure according to the contents)
- ✓ *Communication* (relationship that is established with the users)
- ✓ *Functionality* (all the functions that the site puts at disposal of the users)
- ✓ *Contents* (reliability, updating, understanding of the language)
- ✓ *Management* (guarantee of the correct operativeness of the site)
- ✓ *Accessibility* (possibility, for all, to quickly enter and without problems to the site)
- ✓ *Usability of the site* (facility and pleasantness in the use of the site)

For the evaluating Websites quality, it is possible to attribute a vote to every characteristic (from 0 = very bad to 4 = very good) and to display so the quality site profile through a diagram to star. For the complexity of the macro-characteristics, a good evaluation of quality asks for the decomposition of every characteristic in sub-characteristics. All the characteristics and the sub-characteristics do not have the same importance in the Website evaluation: according to the objectives of the site, it is assigned to each sub-characteristic a weight that expresses its importance in the evaluation, and the vote of every characteristic can be calculated as "weighed media" of the votes assigned to each sub-characteristic.

Figure 6 Diagram to star that unhides "to glimpse" the Website quality profile



Signore, 2005

The *Comprehensive Model for Websites Quality* proposed by **O. Signore** is born of the will to identify same user perceived characteristics, and to relate them to the internal code features, for to identify possible points of weakness, and to proceed with focused user tests. This approach considered the limitations of current quality evaluation approaches: “They often define very *general criteria*, not addressing the specific types of site... differences must be taken into account when measuring the characteristics of the sites are measured, which should be appropriately weighted... Criteria are mainly *qualitative*; hence the evaluation can be error prone or controversial. Criteria are *not orthogonal*: same characteristics are often considered more than once, so contributing to a higher or lower score... Many evaluation criteria are essentially *accessibility or usability biased*; even if the two areas have some overlaps, stressing one of them can be misleading... There is not a clear distinction between page and site quality (*granularity*)... The perception of the quality changes from *different user perspectives* ... To define a metrics, we need *measurable characteristics* and a rigorous approach”²

This Websites quality model provides 5 dimensions or measurement criteria: such criteria can objectively be estimated and measured, and can help to connect the external quality and the internal quality.

The 5 dimensions are:

- ✓ Correctness
- ✓ Presentation
- ✓ Content
- ✓ Navigation
- ✓ Interaction

The *Correctness* is a technical and internal aspect, which can be easily checked by several tools; the other four dimensions instead are more strictly related to the user’s perspective. The *Presentation*

² Signore O., *A Comprehensive Model for Websites Quality*, in “Proceedings of WSE2005 – Seventh IEEE International Symposium on Website Evolution” – Budapest, Hungary – September 26, 2005, ISBN 0-7695-2470-2, pp. 31 – 32.

criteria referred to a single page and include page layout, text presentation, multimedia presentation and link presentation. The *Content* criteria consider the readability, the information architecture, the information structure, the distinction between author and webmaster, and the indication of currency of content (last update date). The *Navigation* criteria consider the navigation bar, the site structure and the horizontal, vertical, mixed navigation. Finally, the *Interaction* criteria consider the transparency, the recovery and the help and the hints. “The main task is to define a *model of the site* and a *quality database*, where to store results gathered by the tools. Automated tools will run and produce detailed information that will be imported in the database... the expert will interact with the database to supply information that can't be derived in an automated fashion... Once the database has been populated with information collected by the automated tools and supplied by the expert, (s)he will query the database to identify possible points where an in depth evaluation and/or testing is necessary...”³

U.C. "Berkeley", 2006

For the web pages evaluation, the University of the California “Berkeley” recommends to adopt two ways: *Techniques to Apply & Questions to Ask*. The Techniques can help to quickly find what we need to know about web pages; asking a series of questions helps us to decide how much a web page is to be trusted.

Some techniques are⁴:

- Before you click on anything written in the page web, glean all you can from the URLs of each page, and choose pages most likely to be reliable and authentic.
- Look for links that say "About us," "Philosophy," "Background," "Biography," "Who am I," etc. If you cannot find any links like these, you can often find this kind of information if you Truncate back the URL.
- Look for the date "last updated"
- The publisher of the page looks
- Look for a link called "links," "additional sites," "related links," etc.
- Find out what other web pages link to this page.
- Use alexa.com URL information;
- Look the page up in a reputable directory that evaluates its contents (Librarians' Index, Infomine, About.com, AcademicInfo...).
- Look up the author's name in Google or Yahoo!
- Step back and think about all you have learned about the page. Listen to your gut reaction. Think about why the page was created, the intentions of its author(s).
- Be sensitive to the possibility that you are the victim of irony, spoof, fraud, or other falsehood.
- Ask yourself if the web is truly the best place to find resources for the research you are doing.

Some Questions are⁵:

³ Signore O., *A Comprehensive Model for Websites Quality*, in “Proceedings of WSE2005 – Seventh IEEE International Symposium on Website Evolution” – Budapest, Hungary – September 26, 2005, ISBN 0-7695-2470-2, p. 32.

⁴ Available at: <http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html>

- Is it somebody's personal page?
- What type of domain does it come from? Is the domain appropriate for the content?
- Who wrote the page? Is it current enough?
- What are the author's credentials on this subject?
- Are sources documented with footnotes or links?
- If reproduced information (from another source), is it complete, not altered, not fake or forged?
- Are there many links? What kinds of sites link to it?
- Is the page listed in one or more reputable directories or pages?
- What do others say about the author or responsible authoring body?
- Why was the page put on the web? Might it be ironic? Satire or parody?

Considerations about examined Websites Quality Models

The observation of some Websites quality models and the individualization, among these, of the characteristics regarding which to evaluate the Websites quality, has allowed to draw some considerations. Initially it could seem that the above introduced theories have individualized different characteristics which corresponded to different concepts in comparison to which to evaluate the Websites quality; however, if we try to abstract the concepts to which the characteristics could make reference, it seems possible to identify few concepts for several characteristics, and this consideration is valid either for characteristics of different quality models or for characteristics presented by the same quality model. These few concepts are: Usability, Content, Navigability, Management and Relationality.

Regarding above introduced Websites quality models, these concepts assemble characteristics which probably are not totally independent; it is possible in fact that several characteristics, though presented with different labels, have similar meanings or recall the same concept; rarely the quality models use the same labels for equal characteristics: perhaps only the Content, and probably because its meaning is less controversial. Often, some models use different labels for characteristics which recall an equal concept. *Maintenance* and *Feasibility* [5] are, respectively, the dimension which “comprises all activities that guarantee proper functioning and operability of the site”, and the dimension which “includes all aspects related to project management”; inside a Websites quality model, these are elements which could recall the concept of Management, like also *Managed* [6] (“A quality Website must be managed to respect legal issues such as IPR and privacy and clearly state the terms and conditions on which the Website and its contents may be used”), and *Preserved* [6] (“A quality Website must adopt strategies and standards to ensure that the Website and its content can be preserved for the long-term”). *Operability*, *Respect legal issues* and *Preserved for the long-term content* can be considered *attributes* of the general concept of Management. *Responsive* [6] (“A quality Website must be responsive, enabling users to contact the site and receive an appropriate reply. Where appropriate, encourage questions, information sharing and discussions with and between users”), *Communication* [8], *Interaction and Relationality* [9] and *Interaction* [10], could recall the concept of Relationality. *Multi-lingual* [6] (“A quality Website must be aware of the importance of multilinguality by providing a minimum level of access in more than one language”) and *Wealth of the Contents* [3] can be considered *attribute* of the concept of

⁵ Available at: <http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html>

Content [5], [8] and [10]. *Identity* [5] (“The image that the organisation projects and therefore all elements that come together in defining the identity of the owner of the site”), *Institutional Characterization* [1], Communicative Style and Graphical System [3] can recall the concept of the Relationality, because they presuppose two subjects which, in the same time, interact. A *basic feature* as “Indication of the user's location within the Website” [12] and an *exciting feature* as “The users have the control of the site” [12] both make reference to the concept of Navigability. It is possible therefore to hypothesize the presence of a set of concepts that frequently occur in the Websites quality models; perhaps they can point out the road toward a new model of quality.

Conclusion

As initially specified, objective of the present study is the observation of some Websites quality models and the individualization, among these, of criteria regarding which to evaluate the Websites quality. Hypothesizing the construction of a Websites quality new model, a Quality Model must have following requirements:

- Defined goals
- To be structurable: to be defined through a list of characteristics
- To have *independent, comprehensible, adoptable, and measurable* criteria.
- To have defined objects/stakeholders or a set of objects/stakeholders as reference.

Every identified criterion must have an unique and accepted definition; subsequently, to every criterion should be associated specific conditions that allow to estimate the degree of presence of the criterion they refer to in the Website under evaluation. For such a purpose, the criteria must be independent from the others and comprehensible for them who uses, adoptable and measurable.

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