



2000-01-01

# Additional quality factors for the World Wide Web.

Ronan Fitzpatrick

*Dublin Institute of Technology*, [ronan.fitzpatrick@comp.dit.ie](mailto:ronan.fitzpatrick@comp.dit.ie)

Follow this and additional works at: <http://arrow.dit.ie/scschcomcon>

 Part of the [Electrical and Computer Engineering Commons](#)

## Recommended Citation

Fitzpatrick, Ronan: Additional quality factors for the World Wide Web. Proceedings of the Second World Congress for Software Quality, Yokohama. Organised by the Union of Japanese Scientists and Engineers, Tokyo, Japan.

This Article is brought to you for free and open access by the School of Computing at ARROW@DIT. It has been accepted for inclusion in Conference papers by an authorized administrator of ARROW@DIT. For more information, please contact [yvonne.desmond@dit.ie](mailto:yvonne.desmond@dit.ie), [arrow.admin@dit.ie](mailto:arrow.admin@dit.ie).



This work is licensed under a [Creative Commons Attribution-NonCommercial-Share Alike 3.0 License](#)



# Additional Quality Factors for the World Wide Web

**Ronan Fitzpatrick**

*Department of Mathematics, Statistics and Computer Science,  
Dublin Institute of Technology, Kevin Street, Dublin 8, Ireland.*

Tel: +353 (1) 4024835 Fax: +353 (1) 4024994

Email: [rfitzpatrick@maths.kst.dit.ie](mailto:rfitzpatrick@maths.kst.dit.ie)

**Keywords:** WWW quality, usability, accessibility, visibility, intelligibility, credibility, engagibility, differentiation, characteristics, checklist of enablers.

## **Abstract**

Web site development is maturing from the enthusiastic experimental practice of early years to a more professional discipline, addressing the needs of Web site visitors and owner organisations. Quality is central to this maturing and it is necessary to have a full understanding of the meaning of quality in the context of the ever-changing Web. This paper identifies five new quality factors for the Web (visibility, credibility, intelligibility, engagibility and differentiation), together with their characteristics and a checklist of enablers, which can be used by specifiers, designers, developers and evaluators to create quality Web sites.

## **1 Introduction**

According to Bevan /1/ “*Web sites provide a unique opportunity for inexperienced information providers to create a new generation of difficult to use systems*”. It is frequently the norm to visit a Web site which has been difficult to find, is poorly structured, is difficult to navigate and is difficult to read. Some sites take so long to download that users become impatient and leave. These sites are often developed by enthusiastic beginners who have the perception that a quality site is one that demonstrates the latest multimedia and animation effects. These beginners are not yet experienced in user-centred requirements for quality systems /2/. Little attention is paid to usability measures like effectiveness, efficiency and satisfaction. Neither is there a corporate Web site strategy, which offers Web site owners a return on their investment. The result is failure as described by Bevan. Consequently, the users’ sense of satisfaction with the site is low and organisations that require a Web presence do not obtain a quality site. This paper addresses Web site quality requirements and identifies domain-specific quality factors for the World Wide Web. It is of interest to Web site owners, specifiers, designers, developers, evaluators and users. It is based on a literature search and on observational studies of over 250 Web users. Section 2 presents an overview of software quality. Section 3 identifies the special quality requirements for Web sites and explains these requirements in detail. Section 4 considers their usage.

## **2 Overview of software quality factors**

Software quality was first defined in the 1970’s by researches like McCall *et al.* /3/ and Boëhm, /4/. Their research was later complemented by standards like IEEE and ISO. More recently, Fitzpatrick and Higgins /5/ conducted a methodical analysis and synthesis of three strands - quality (as explained by McCall *et al.* and by Boëhm), statutory obligations, and human-computer interaction, which influence software quality. This established a comprehensive set of quality factors as shown in Figure 1.

EXTERNAL QUALITY FACTORS		INTERNAL QUALITY FACTORS
<ul style="list-style-type: none"> <li>• Suitability</li> <li>• Installability</li> <li>• Functionality</li> <li>• Adaptability</li> <li>• ease-of-use</li> <li>• learnability</li> </ul>	<ul style="list-style-type: none"> <li>• interoperability</li> <li>• reliability</li> <li>• safety</li> <li>• security</li> <li>• correctness</li> <li>• efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• maintainability</li> <li>• testability</li> <li>• flexibility</li> <li>• reusability</li> <li>• portability</li> </ul>

**Figure 1.** *Software quality factors – (After Fitzpatrick and Higgins, 1998)*

All of these quality factors must be considered as part of a Web site development strategy. However, they were devised prior to the commercialisation of the Internet and are more focused towards traditional data processing and information retrieval. This research shows that they are insufficient for the requirements, opportunities and challenges for both user and organisation, which are presented by the changing and active Web.

### **3 Web site quality requirements**

In order to understand the quality requirements of a Web site, it is necessary to consider the purpose of Web site software. From a user perspective there is a substantial range of “need-to-include” features, which are appropriate to Web sites. Web sites need to be easy-to-find, easy-to-download and easy-to-understand. Users need to be confident with the content of the site and with the objectives of the site owner. Web sites need to be interactive and need to incorporate a full range of navigational aids. From an organisational perspective, Web site software is intended to communicate an organisational image and message, to inform visitors to the site, to support access to information and knowledge and to support the sale of products and services through electronic commerce /1,6/. These objectives for Web site applications are different to those of traditional applications, which generally perform a data processing activity. Consequently, Web sites have different quality considerations.

#### **3.1 Current research**

Researchers are addressing these issues /7,1,6,8/. The topics of research include visual appearance, access, navigation, appeal or excitement, quality content, interactivity, trust, multimedia and download speed. The World Wide Web Consortium /9/ have initiatives and research projects, which are focused on “accessibility to the Web for all”. Their guidelines address ease-of-access, understandability and usability. Analysis of this research clearly illustrates a concentration on Web page content, consistency and style. Consequently, the issues that impact quality Web sites are not being fully addressed and lack focus. The following sections show that it is more appropriate to focus or group the topics into domain-specific quality factors.

#### **3.2 Web site quality factors**

Based on the analysis of current research as outlined in Section 3.1, Web site quality topics are now grouped together under five requirements headings – Communicating with Web sites, Understanding the content, Confidence in the content, Engaging the visitor, and Corporate matters. The paper shows that these requirements constitute new quality factors, which are specific to the World Wide Web domain. This paper names them as visibility (easy-to-communicate with), intelligibility (easy-to-assimilate

and interpret), *credibility* (level of user confidence), *engagability* (extent of user experience) and *differentiation* (demonstration of corporate superiority). Each of the quality factors is now explained. The explanation includes a rationale and a definition for each quality factor together with the characteristics of each quality factor and how it is supported or enabled.

### 3.2.1 Communicating with Web sites (Visibility)

Web sites are stored at unique locations and these locations have to be found by the visitor and by search engines. Finding a site can be time consuming and difficult to the point of frustration. The URL used to uniquely identify a site can be verbose thereby resulting in an incorrectly typed address. Or, it can be so similar to another URL that it is mistyped and the wrong site is visited. Case-sensitive URLs are also a hindrance to users. URLs are addressed by Nielsen /10/.

There is a visitor expectation that once you are navigating the Web all sites are contactable. All too often sites are closed or moved with no forward address.

Many site owners make extensive use of multimedia techniques. Sometimes these can be so overused that the download time for a site becomes extremely slow and visitors become impatient and move on. Download time is a significant concern for many researchers /11,12,13/.

So, the first essential domain-specific quality factor for a Web site is that it must be easy-to-find, easy-to-download and easy-to-access /13/. This paper names this quality factor, *visibility* and defines it as the ease with which users can visit a Web site. It is concerned with *tracability*, *retrievability* and *ease-of-access*.

*Tracability* supports potential visitors by enabling them to find and refind a Web site. *Retrievability* addresses the download time associated with Web site activity. *Ease-of-access* is the ease with which users can gain entry to the Web site and is supported by the welcoming philosophy of the Web site owner.

### 3.2.2 Understanding the content (Intelligibility)

Many researchers are concerned with the challenge of designing Web pages to properly reflect the combining of traditional best practice for text documents with best practice in a multimedia environment /1,8,11,14/. All researchers are concerned that Web sites should be easy-to-read and easy-to-understand (Keevil, 1999; Network Solutions, 1999). For completeness, this paper adds that where sound is used it must be easy-to-hear and relevant to the application. Researchers are also conscious that Web sites need to be presented in multiple languages and avoid offence to international cultures. So, the second domain-specific quality factor for the Web is that it should be easy-to-read, easy-to-hear and easy-to-understand. This paper names this quality factor, *intelligibility* and defines it as the ease with which users can assimilate and interpret the content of the Web site. It includes *legibility*, *audibility* and *comprehensibility*.

*Legibility* is concerned with presentation at the user interface. *Audability* is concerned with the use of earcons and the appropriate use of the spoken word, sound and music. *Intelligibility* also includes *comprehensibility*. This is the manner in which all of the

characteristics of intelligibility are crafted together into a framework of pages (Bevan /1/ names this as site structure).

### 3.2.3 Confidence in the content (Credibility)

Once a site has been found, users need to know that the site owner and the site content can be trusted. An analogy is the option to rely on a research journal or a tabloid newspaper. In each instant the reader has an understanding and confidence in the quality of the different editorial policies. Furthermore, site visitors need to be confident that the content of the site is accurate. So, the third essential domain-specific quality factor for a Web site is that it must be easy-to-trust and the content must be accurate /10,15/. This paper names this quality factor, *credibility* and defines it as the level of user confidence with the Web site. It is concerned with the *integrity* of the owner and the *accuracy* of the content.

*Integrity* is the extent to which a visitor has confidence in the owner's motivations, qualifications and trustworthiness /8/. *Accuracy* is concerned with the correctness and currency of the content presented on the Web site /10/.

Users are unlikely to return to site with a perceived low credibility. So, in the absence of an independent accreditation system, Web site credibility must be established by the owner's efforts over a period of time.

### 3.2.4 Engaging the visitor (Engagibility)

For those with responsibility for implementing successful electronic commerce (E-commerce) solutions there are other significant considerations. Gehrke and Turban /13/ explain that these are customer and marketing focused. From a customer focus, having enabled visitors to find the Web site, organisations need a strategy to detain these customers for maximum benefit. Their strategy should also include mechanisms to re-attract visitors back to the site. They will also be concerned to ensure that they are not funding links to sites that they have no control over and which might, in turn, link to other sites with which they compete. Nor would they wish to be legally compromised by their outbound links. The concept of containing the boundaries of Web sites is already with us and is a quality consideration for Web site owners. Some owners believe that a one-stop-shop which caters for a user's complete E-commerce, information, communication, education and entertainment needs is providing a quality Web service. Other Web site owners are of the view that to insure the fullest return for their investment, their site should not be used as a surf station. Researchers are addressing these issues under the headings of navigation, interactivity and site appeal /6,7/. This paper names this quality factor, *engagibility* and is the fourth domain-specific quality factor for a Web site. *Engagibility* is the extent to which a Web site can fully engage a visitor by providing a complete and comprehensive Web site experience. *Engagibility* includes *navigability*, *interactivity* and *appeal*.

*Navigability* is the ability of Web site visitors to access any part of the Web site or to link to other Web sites. *Interactivity* addresses the engagement of site visitors and enables them to complete whatever process or experience is offered by the site. *Engagibility* is also concerned with creating Web sites that appeal to visitors. According to Keeker /7/, appeal can be achieved under five headings viz. relevant high-quality content, easy-of-use, promote effectively, (on site and in other media), a experience unique to the medium and evoke emotion.

### 3.2.5 Corporate matters (Differentiation)

From a marketing focus, Corporate image and product branding are important organisational considerations. So, it is natural that organisations are concerned to know that their investments in Web sites have the correct corporate influence and marketing impact on visiting customers. While their corporate image is extremely important and needs to demonstrate a modern, professional and progressive image, preoccupation with button-bars, graphic decorations and animation effects is less significant. Bevan /1/ who explains that a quality Web site should portray a strong organisational image or brand, which demonstrates organisational superiority, confirms this. This paper names this quality factor, differentiation and is the fifth quality factor for a Web site. It is concerned with product speciality together with corporate image and branding.

Differentiation is defined as the extent to which a Web site demonstrates corporate superiority. Ginsburg and Kambil /17/ explain that as we undertake electronic commerce, business strategy becomes more visible to competitors, so, an organisation's capacity to leverage knowledge assets better than its competitors becomes a key source of competitive differentiation. The more successful the organisation is at exploiting the leverage the more superior its Web site becomes.

This paper proposes that a Web site's principal offering is its *speciality*, which equates to product (or service). Typical examples would be bookstore sites or domain name registration sites where the owner strives to make the Web site the number one Web site world-wide for that product or service.

The second distinguishing consideration is image, and this paper names it as *identity*, that is, the way an organisation wishes to identify itself or position its product.

Differentiation is not widely addressed by current software quality researchers and authors. Bevan /1/ mentions branding, and Ginsburg and Kambil /17/ mention competitive differentiation. However, most researchers are concerned with end-user considerations. Differentiation is of more interest to strategic management whose quality measures also include return-on-investment and potential to attract visitors (Web site hits).

Figure 2 concludes this investigation of the five quality requirement headings and their associated quality factors. Each of the quality factor definitions is now tabulated together with a summary of its Characteristics and is combined with a Checklist of Enablers for each factor.

QUALITY FACTOR	CHARACTERISTICS	CHECKLIST OF ENABLERS
<b>Visibility</b> The ease with which a user can visit a Web site.	<ul style="list-style-type: none"> <li>• Tracability</li> <li>• Retrievability</li> <li>• Ease-of-access</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Appropriate URL</li> <li><input type="checkbox"/> Search Engine registration</li> <li><input type="checkbox"/> Efficient hosting servers</li> <li><input type="checkbox"/> Site forwarding</li> <li><input type="checkbox"/> Meta tags</li> <li><input type="checkbox"/> Summary paragraphs</li> <li><input type="checkbox"/> Efficient multimedia usage</li> <li><input type="checkbox"/> Minimal access registration</li> <li><input type="checkbox"/> Minimal password</li> <li><input type="checkbox"/> Multiple browser support</li> </ul>
<b>Intelligibility</b> The ease with which a user can assimilate and interpret Web site content.	<ul style="list-style-type: none"> <li>• Legibility</li> <li>• Audibility</li> <li>• Comprehensibility</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Style standards</li> <li><input type="checkbox"/> GUI standards</li> <li><input type="checkbox"/> Effective use of sound</li> <li><input type="checkbox"/> Effective multimedia usage</li> <li><input type="checkbox"/> Culture/Tradition issues</li> <li><input type="checkbox"/> International languages</li> <li><input type="checkbox"/> Audience profile</li> </ul>
<b>Credibility</b> The level of user confidence with the content of the Web site.	<ul style="list-style-type: none"> <li>• Integrity</li> <li>• Accuracy</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Owner's identity</li> <li><input type="checkbox"/> Owner's motivations</li> <li><input type="checkbox"/> Owner's qualifications</li> <li><input type="checkbox"/> Owners trustworthiness</li> <li><input type="checkbox"/> Accurate content</li> <li><input type="checkbox"/> Current content</li> </ul>
<b>Engagibility</b> The extent to which a visitor achieves a complete experience at a Web site.	<ul style="list-style-type: none"> <li>• Navigability</li> <li>• Interactivity</li> <li>• Appeal</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Menu structure</li> <li><input type="checkbox"/> Home</li> <li><input type="checkbox"/> Keyword search</li> <li><input type="checkbox"/> Hyperlinks</li> <li><input type="checkbox"/> Signposting</li> <li><input type="checkbox"/> Data retrieval</li> <li><input type="checkbox"/> Online E-commerce</li> <li><input type="checkbox"/> User-defined preferences</li> <li><input type="checkbox"/> Email communication</li> <li><input type="checkbox"/> Comments forum</li> <li><input type="checkbox"/> Chat room</li> <li><input type="checkbox"/> Questions Bulletin Board</li> <li><input type="checkbox"/> Offer a Unique experience</li> <li><input type="checkbox"/> Evoke emotion</li> </ul>
<b>Differentiation</b> The extent to which a Web site demonstrates corporate superiority.	<ul style="list-style-type: none"> <li>• Speciality</li> <li>• Identity</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Dominant product/service</li> <li><input type="checkbox"/> Corporate logo</li> <li><input type="checkbox"/> Brand symbol</li> </ul>

**Figure 2.** – *Domain-specific quality factor definitions, characteristics and enablers.*

#### **4 Using the domain-specific quality factors**

As organisations engage in E-commerce, they will need assurance that their investments in Web sites will not be wasted and that they will receive a return on their investments. So, the DOMAIN-SPECIFIC QUALITY FACTORS identified in this paper will focus their Web site design and evaluation is search of high return-on-investment and site usage. The DOMAIN-SPECIFIC QUALITY FACTORS when combined with THE CORE QUALITY FACTORS (Figure 1) can be used as essential components for a quality accreditation system for Web sites. The ENABLERS shown in Figure 2 can be used by all IS professionals as essential issues to be addressed when creating quality Web sites.

## 5 Conclusion

This paper explains the manner in which Web sites are currently developed without reference to quality considerations. The paper addresses these quality considerations and introduces new quality factors specific to Web sites. Five new quality factors - visibility, intelligibility, credibility, engagibility and differentiation, are introduced, defined and presented with a checklist of enablers. Future research should address software tools, which support the successful achievement of these new quality factors. It should also address the quality evaluation of Web sites and establish metrics for these new quality factors. This paper has also shown that as new domains evolve and are understood there is a need to review our interpretation of quality in those new domains and where appropriate new domain-specific quality factors identified.

## 6 References

1. Bevan, N. (1998) *Usability issues in Web site design*, Proceedings of UPA'98, Washington DC
2. De Troyer, O. (1999) *Designing well structured websites: lessons to be learned from database schema methodology*, Conceptual modelling – ER'98. 17th International Conference on Conceptual Modeling, Proceedings p. 51-64, Springer-Verlag, Berlin, Germany
3. McCall, J., Richards, P. and Walters, G (1977) *Factors in software quality*, Vols I-III, Rome Aid Defence Centre, Italy
4. Boëhm, B. (1978) *Characteristics of software quality*, Vol 1 of TRW series on software technology, North-Holland, Amsterdam, Netherlands
5. Fitzpatrick, R. and Higgins, C. (1998). *Usable software and its attributes: A synthesis of software quality*, *European Community law and human-computer interaction*, In: People and Computers XIII. Proceedings of HCI'98 Conference, Springer, London, UK
6. Dreyfus, P. (1998) *Usability and the Future of the Web*, Devedge View Source Magazine, Netscape [http://developer.netscape.com/news/viewsource/archive/editor98\\_1\\_20.htm](http://developer.netscape.com/news/viewsource/archive/editor98_1_20.htm) Accessed June 1999
7. Keeker, K. (1997) *Improving Web Site Usability and Appeal: Guidelines* compiled by MSN Usability Research, 22 September 1998 <http://msdn.microsoft.com/workshop/management/planning/improvingsiteusa.asp> accessed June 1999
8. Nielsen, J. (1998) Content usability, NPL:Usability Forum - Making Webs Work, Tutorial, NPL, Middlesex, UK
9. W3C, (1999) Unified Web Site Accessibility Guidelines [http://trace.wisc.edu/docs/html\\_guidelines/htmlguide.htm](http://trace.wisc.edu/docs/html_guidelines/htmlguide.htm) accessed June 1999
10. Nielsen, J. (1996) Top ten mistakes in Web design, Sun Microsystems, <http://www.sun.com/960416/columns/alertbox/index.html> accessed June 1999
11. Trower, T. (1999) The Human Factor: Guidelines for Designing Interactive HTML Documents, [http://www.microsoft.com/devnews/SepOct96/HumanFactor5\\_5.htm](http://www.microsoft.com/devnews/SepOct96/HumanFactor5_5.htm) accessed June 1999
12. Nielsen, J. (1999) *User interface directions for the Web*, Communications of the ACM, Vol 42(1), p65-72
13. Gehrke, D and Turban, E. (1999) *Determinants of successful Website design: relative importance and recommendations for effectiveness*, Proceedings of the 32nd Annual Hawaii International Conference on Systems Sciences, IEEE, Los Alamitos, CA, USA
14. Lynch, P. and Horton, S., (1999) *Web Style Guide: Basic Design Principles for Creating Web Sites*, Yale University Press, USA
15. Keevil, B. (1999) *Measuring the usability index of your Web site*, Sixteenth Annual International Conference of Computer Documentation. Conference Proceedings. Scaling the Heights: Future of Information Technology p. 271-277, ACM, NY, USA
16. Instone, K. (1999) 15 sub-topics or general issues that impact Web usability, Usable Web, <http://usableweb.com/items/issues.html> accessed June 1998
17. Ginsburg, M. and Kambil, A. (1999) Annotate: a Web-based knowledge management support system for document collection, Proceedings of the 32nd Annual Hawaii International Conference on Systems Sciences, IEEE, Los Alamitos, CA, USA