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ITP4518

2QCV2Q: A Model for Web Sites Design and Evaluation

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ABSTRACT

In this paper we introduce a general model for web site design and evaluation. The model has been developed within a research program concerning on-line marketing research. However, given its flexibility, it can be applied to the development or the evaluation of web sites, independently of their goals and domain. To validate the model we applied classic rhetorical principles based on ciceronian loci or argumentum, which can be used to check the completeness of an exposition. To illustrate the application of the model we report here the results of the analysis of a ski consortium web site in the Dolomites.

1. INTRODUCTION

This paper proposes a model for the evaluation and design of web sites. The model was initially developed as a framework for market research in the tourism sector using questionnaires administered via Internet.[1] However, its flexibility is such that it can be used as a tool for the analysis and evaluation of web sites independently of their goals and domain. The model is based on a number of important considerations regarding the quality of sites. In particular, one should bear in mind that developing a web site requires a wide variety of skills, ranging from software engineering to graphics, to marketing, and also that the tools available for this purpose grow increasingly sophisticated, so that anyone can rapidly create their own site. The crucial problem is finding a reference scheme that enables the development of a quality site. The concept of quality comprises two important components: the process and the product. Given that a software product is involved, to develop a web site we may use classical life-cycle models. It is therefore advisable to envisage the standard phases of planning, analysis, design, implementation and maintenance. However, the hypermedia nature of the Internet and the importance of aspects to do with interfaces, speed of access to information, and the security of transactions differentiate the development of web sites from that of a traditional information system. Moreover, development of a site often involves people who are not IT experts and who design the site without taking account of, for example, the technical constraints on its accessibility. On the other hand a software engineer who is unacquainted with semiotics or the principles of graphics, or of marketing, may create a site which fails to convey the company's image and to achieve its goals. For these various reasons, also the evaluation of the quality of a site, understood as the product of a complex process, should be based on a variety of criteria. As well as the type of site – corporate, personal or commercial, set up for an association or a university, etc. – evaluation depends on the target user and above all on the analyst's goals. The model proposed here incorporates the classical principles of rhetoric used to determine the completeness of an exposition. The elements to consider – the *circumstances* – were first introduced in Cicero's *De Inventione* and redefined in medieval treatises. These were a set of properties, or *loci*, and the relative questions, which have recently become widespread in journalism, where they take the simplified form of the rule of the 5 **wh-questions**: who, what, why, when, where. Thus yielded is a model that can be used to single out elements which, when suitably combined, permit evaluation of the quality of a web site and make suggestions for its improvement. Symmetrically, the model provides guidelines for the design of a site. Its application is relatively simple and does not require specific computer skills. On the other hand, since it is based on well-founded principles of rhetoric, its robustness and completeness can be easily verified.

The paper is organised as follows. The next section introduces the model for evaluating and designing web sites, what we call the 2QCV2Q model, from the initials of the Ciceronian *loci* on which it is based. Section 3 described the steps involved in applying the model. Section 4 sets out the results of evaluation of the web site for the Dolomiti Superski consortium. A first evaluation was carried out in 1998 during analysis of the results from an on-line questionnaire used to define the profile of the winter tourist. A second evaluation was carried out in September 1999 in order to gauge the effects of a drastic revision of the site. The final section draws some conclusions and outlines further applications of the model.

2. WEB SITES ANALYSIS AND EVALUATION

2.1 The problem

The literature proposes numerous evaluation schemes which highlight the aspects that their authors deem most relevant to the context in which the analysis is to be made[11]. In the corporate sector, worthy of note is the model proposed in [4] for a survey to find the 100 best company sites in the world, and the scheme used by the ENTER Web Award Committee.[2] The features considered are both technical aspects (for example, ease of navigation through the site, speed of access, compatibility with various browsers) and the functions offered by the site. In the case of an e-commerce site, for instance, checks are made on the availability of information about products and prices, purchases on-line, etc. Some models analyse the nature of the site or evaluate information sources for those selecting sites to include in information source guides.[3] Other models highlight aspects to do with the interaction between the user and the owner of the site[4], for instance the possibility of sending e-mails or the existence of mailing lists. Then there are models used by organisations which check the quality of a site on request by the user, examples being the evaluation schemes proposed by HTML Point[5] and Atlantis[6]. Besides evaluation of a site, all these models can be used as reference frameworks for designing a site. However, analysis of them shows that a theoretical scheme is required to orient the choice of the features and properties to consider when evaluating a site.

2.2 The 2QCV2Q web sites analysis and evaluation model

The following considerations should be borne in mind when defining a theoretical framework for quality web site development:

- The quality of a site depends both on the process and on the final products. Required therefore is an approach based on both traditional models of the development life-cycle and on *the distinctive elements of a web site*. The identification and classification of these elements are the main goals of the 2QCV2Q model. Moreover, given the object-based structure of a hypermedia,[7] it is possible to adopt an object-oriented method using the Unified Modeling Language.[8]
- Thanks to the software tools supporting web site development, the advantages (and disadvantages) are similar to those encountered when adopting a prototyping development technique.[9] In particular, it is possible to involve the user or the customer more closely.
- *The people involved in sites design have different skills*, so that software engineers tend to overlook graphical aspects or to neglect the characteristics of multimedia communication and the needs of the site owner. On the other hand, graphic designers, who are often in charge of web site development projects, are unaware of the characteristics of the technology that determine the performances of the site.
- *Web sites differ from traditional software systems in important respects*: for example, speed usually matters more than the presentation of information, which in turn matters more than content. However, definition of the needs of the site, design of the site, and implementation require closer involvement of the user.

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On this basis, therefore, we have the fundamental requirements for a web site design and evaluation model, viz.:

- The model must be *general*, so that it can be applied to various types of site, whether corporate, individual, education, for business-to-business applications or business-to-customer ones, etc.
- The model must be *domain independent*, so that it can be just as easily applied, for example, to the tourist sector as to non-profit organisations, to the automobile sector as to the public administration.
- Application of the model must not require highly specialised expertise, neither in information technology nor in marketing or multimedia communication (*usability*).
- All the elements necessary to guarantee the quality of a site must be present, so that the model is *robust*.

The last point prompted us to develop a model based on principles taken from classical rhetoric. It should be pointed out that the cognitive and social function of rhetoric is to discover and explain the rules of communication [5]. Its function is not to persuade, but to find the persuasive means that surrounds each argument. The rhetoric rules to verify the completeness of an exposition are stated in the form of *loci*[10] and their corresponding questions. These *criteria* were defined in medieval treatises on the basis of Cicero's famous work *De Inventione*.

According to the rhetorical model of argumentation, the expositions (*expositio*) of a document may be viewed as a series of answers to the questions comprised in the Ciceronian model. The first version of our analysis and evaluation model contained six main dimensions, corresponding to six *loci*:[11]

Identity	->	QUIS? (Who)
Content	->	QUID? (What)
Services	->	CUR? (Why)
Location	->	UBI? (Where)
Management	->	QUANDO? (When)
Usability	->	QUOMODO? (How)

Table 1 - The 2QCV2Q model

CICERONIAN LOCI	Attributes
QVIS (*Persona:* Who?) **IDENTITY**	IDENTIFICATION – Brand (organisation or company); Charisma (individual) – Image CHARACTERISATION – Design – Personalisation
QVID (*Factum:* What?) **CONTENT**	COVERAGE – Domain referred to owner's and users' goals – Value of information and links ACCURACY – Quality of information – Source(s), author(s)
CVR (*Causa:* Why?) **SERVICES**	**Functionalities** – Adequacy to owner's goals – Adequacy to users' goals **Control** – Correctness – Security, ethics and privacy
VBI (*Locus:* Where?) **LOCATION**	**Reachibility** – Intuitive URL – Retrieval INTERACTIVITY – Contact information – Community building
QVANDO (*Quando:* When?) **MANAGEMENT**	CURRENCY – Update – Dates **Maintenance** – Check-up – Tools
QVOMODO (*Modus:* How?) **USABILITY**	**Accessibility** – Hardware and Software requirements – People with disabilities **Navigation** – Structure, Orientation – Download times **Comprehensibility** – Languages – Level of terminology

The complete model is given in Table 1, where each dimension is matched by a relatively limited number of attributes on which analysis of a site may be based. Obviously, the significance's and meanings of these attributes differ according to the site to which the model is applied. Before evaluating a site, therefore, it is necessary to personalise the model in the manner described in section 3.

In the light of the model proposed, also the design of a site can be viewed as a series of replies to the question set by the Ciceronian model, bearing in mind that information on the web is usually available via hypermedia documents. It is therefore necessary to convert an argumentative model into a conceptual model of a hypermedia [2]. A design which respects the above Ciceronian principles enables organisation of both content and the tools necessary for the correct and easy use of the information, as well as foreseeing the user's needs.

We now briefly describe each dimension of the model. It should be noted that these dimensions are interrelated, so that, for example, good graphic characterisation based on numerous images or animations may make downloading slower, and therefore reduce usability, etc.

Identity (Quis?) A site with a strong *brand identity* remains impressed on the minds of those who visit it and forcefully conveys the company's *image*:[12] see, for example the Ferrari site with its almost entirely red background,[13] or the site for Benetton's *Colors Magazine*[14]. In the case of a personal site, identification is based on *charisma and authoritativeness*. The *characterisation* of a site can be evaluated in terms of the site *design*, using the industrial design approach, which seeks to combine artistic and graphical aspects with the functionality of products. Consideration is therefore made of both the graphical presentation and the use of other elements which make the site attractive to visitors. Another important aspect is the ability of the site to adapt its identity to the user, *personalising* its language or functions.[15] The overall objective is to increase the user's trust in the owner of the site.

Content (Quid?) Content is evaluated in terms of the site's *coverage* of its domain according to the requirements of the site owner and the user. For example, if the purpose of the site is to offer an on-line sales service, it must contain all the information that the user needs to make a purchase, and therefore information on the product, on payment, etc. The *value* and originality of the information should also be evaluated. Consequently, it is necessary to examine the *links*, which should connect with pages that the user will find useful. Examination should also be made of the links which lead the navigator to resources external to the site, given that these may induce the user to abandon the web site in question.

Since the value of information is closely bound up with its *quality* and *accuracy*, assessment is required of its precision and reliability, which in turn depends on the *source* of the information itself.

Services (Cur?) The *functions* offered by the site should be evaluated from the points of view of both the *owner* and the *user*. The owner will include the functions that best enable achievement of his goals. Users will access the site in order to visit it and, according to the type of site, will expect to find functions that help them to do what they want: find information, amuse themselves, etc. Besides the adequacy of the functions provided, their *correctness* and *security* and secure use of personal information should be evaluated. For example, an on-line flight booking service should offer the same guarantees as a travel agency.

Location (Ubi?) This dimension concerns both the *reachability* of a site and the ability of the user to *interact* with the host and with other users. A site can be easily identified if it has an *intuitive URL*, which incorporates, for example, the name of the company or Organization, or refers to its business. Users may *locate* the site by means of *search engines*, so that it is important that the site employs all the devices that improve its ranking (see for example the list given in [12]). As far as the site's *interactivity* is concerned, this can be supported by the presence of the owner's or webmaster's e-mail address, postal address, and telephone and fax numbers. At another level there should be functions for creating *virtual communities* – newsletters, mailing lists, membership plans [6], guestbooks [13] – around the site.

Management (Quando?) Management of a site involves *updating* the information that it provides. Consider, for example, the prices and schedules posted on the Greyhound site,[16] which if they are to be any use need to be constantly updated. Other useful indicators are the presence of the *dates* of the site's *establishment* and its last *revision*. True site management is *corrective*: it guarantees the stability of the site, so that server crash does not prevent users from accessing it. And it also checks the functioning of the site, ensuring for example that there are no broken links. Also necessary is *adaptive* and *perfective maintenance* to make sure that

the site is up-to-date in its technology and tools.

Usability (Quomodo?) The last dimension of the model concerns all the aspects, which enable relatively undemanding use of the site in terms of cost, time or cognitive input. Evaluation is first made of the *hardware* and *software* required to access the site. It is important, for example, that access to a site should be possible using any browser, and that it does not require unnecessary plug-ins. Close attention should also be paid to guaranteeing access for *people with disabilities*. Disorientation may be another problem for the user. This can be reduced by providing a *site map* or *online help*, but above all by designing the *structure* of the site so that it facilitates navigation. Equally important is evaluation of page *download times*, which should be reasonable even for users with relatively slow connections.[17] Finally, an efficient site also offers a *choice of languages*, and uses easily understandable *terms and symbols*.

3. APPLICATION OF THE 2QCV2Q MODEL

The first step in application of the model is its personalisation to take account of the goals of the owner, of users, and of the category to which it belongs. On the basis of these elements a weight must be assigned to the various sub-attributes. For this purpose the designer may ask for help from the company or organization and interact with a certain number of site users. It is to be stressed that the various attributes differ greatly in complexity. For example, it is much more difficult to evaluate the comprehensiveness of a site's contents or graphics than it is to evaluate its correct functioning. This affects both the resources necessary to design or evaluate a site and the amount of automatic support required.

3.1. Tools for site evaluation

Evaluation of some attributes can be automatized, at least partly, by using software tools available commercially or on-line. These tools can be used to construct a map of the site, to acquire information on the type of files and links present in the site, to discover when a site was last updated, to gauge the weight of pages, etc. We mention, by way of example, *web site watchers* like Astra SiteManager®[18] or Linkbot®[19], and *validators* like BOBBY®[20], programs[21] which signal instructions incompatible with a certain version of HTML or with a particular browser, and the degree of accessibility for disabled users.

As far as the 2QCV2Q model is concerned, web site watchers, validators or search engines can be used to support the analysis of its last three dimensions: *Location*, *Management* and *Usability*, which are the three dimensions least tied to 'syntactic' aspects, and least dependent on contents and therefore on semantics.

4. EVALUATION OF THE DOLOMITI SUPERSKI WEB SITE

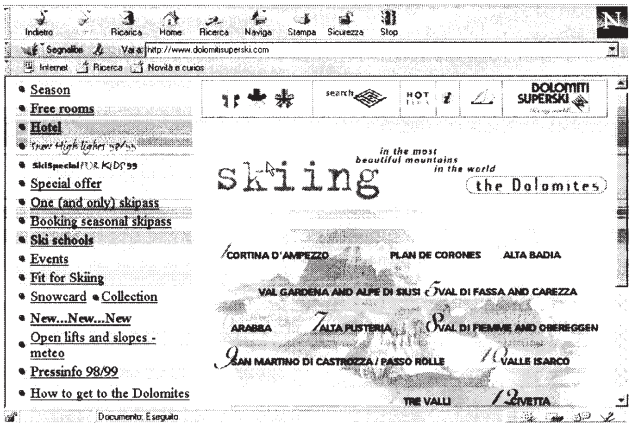
In order to illustrate the application of the 2QCV2Q model, we now present the results of evaluation of the web site for Dolomiti Superski (figure 1),[22] a ski consortium in the Dolomites.[23] The main objectives of the site owner were:

- to publicise the area
- to promote the Consortium's services
- to publicise the hotels belonging to the Consortium
- to sell the services offered by the Consortium and by the hotels.

The site should therefore have contained exhaustive information on the services offered by the Consortium and by the hotels belonging to it. As regards the Consortium, the site should have given information about the services offered, how to reach the various localities in the area, special offers, the speed and capacity of lifts, etc.; as regards the hotels, information about services, categories, prices and seasonal terms, location, etc. Important functions were those typical of an e-commerce tourist site, notably a site search facility, communication with the site, the on-line booking and purchase of the services offered.

Analysis of a site divides into two main stages. The first involves *personalisation of the model* with the assigning of weights to the attributes on the basis of individual objectives. The second involves *a careful visit to the site, assigning scores to the various items* on a scale from 0 to 4 (0 = non-existent, 1 = poor, 2 = adequate, 3 = good, 4 = excellent). To facilitate this work, a table was constructed which comprised a number of essential questions relative to each dimension of the model. The results of evaluation of the Dolomiti Superski site are given in Table 2. Shading has been used to highlight the items for which the software tools described in the previous section can be used.

Figure 1 - Home Page of the Dolomiti Superski Consortium (August 1998)



It was possible to conclude from the analysis that the Consortium's site provided clear, complete and reliable information, which met the needs of the user (*Content*). The characterisation was good, especially as regards graphics and content (*Identity*).

As for *Services*, the facilities offered were barely sufficient, although they worked efficiently. It was, in fact, impossible to book hotels and purchase ski passes on-line. *Location* was satisfactory: the URL address was easy to remember; moreover, the site was well referenced and easy to find with the most widely used search engines. The *Management* of the site was very good, especially in view of the constant updating of the pages,

Table 2 – Application of the 2QCV2Q model to the Dolomiti Superski site (August 1998)

		Weights	Scores
IDENTITY			
	Does the site have strong *Brand Identity* or *Charisma*?	0.25	3
	Does the site convey an adequate corporate image?	0.25	4
	Does the site have good graphical and functional characterisation?	0.25	4
	Is the site able to adapt to the user?	0.25	2
			3.25
CONTENT			
	Does the information match the aims of the site?	0.25	4
	Are the information and links useful?	0.25	4
	Is the information accurate?	0.25	4
	Are the sources of the information given?	0.25	3
			3.75
SERVICES			
	Do the functions match the aims of the site owner?	0.25	3
	Do the functions match the aims of the user?	0.25	2
	Are the functions free of errors?	0.30	3
	Are transactions secure and is privacy respected?	0.20	1
			2.35
LOCATION			
	Is the site's URL intuitive and easy to remember?	0.30	3
	Does the site have good visibility, is it easy to find with a search engine?	0.30	3
	Is it possible to contact the owner or the webmaster?	0.30	4
	Is it possible to interact with other users of the site?	0.10	0
			3.00
MANAGEMENT			
	Is the information up to date?	0.50	4
	Do the dates of the last updating and creation of the site appear?	0.20	0
	Is the site well maintained?	0.25	3
	Does the site use adequate technology?	0.25	3
			3.50
USABILITY			
	Does using the site require standard HW and SW?	0.20	2
	Are there devices to help the disabled?	0.20	2
	Are page downloading times satisfactory?	0.20	2
	Is it easy to navigate through the site? Is there a site map or help on-line?	0.10	1
	Is it possible to choose among languages?	0.20	3
	Are the terms and symbols easy to understand?	0.10	3
			2.20

Figure 2 – Evaluation of the Dolomiti Superski site (August 1998)

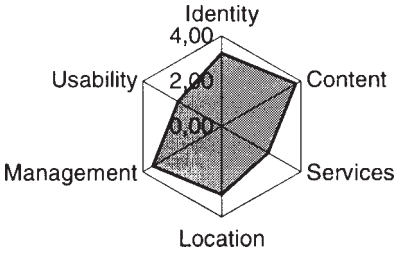
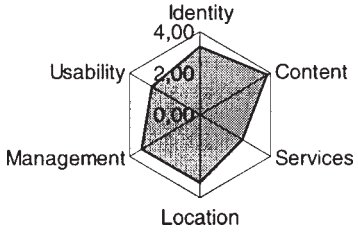


Figure 3 – Evaluation of the Dolomiti Superski site (September 1999)



although the date of the most recent revision was missing.

Finally, the *Usability* of the site was almost good, but had two drawbacks: first, the user was not helped while navigating, either by an on-line map or by a guide or help facility; second, the large number of images wasted the user's time: in particular, the home page amounted to almost 100K and contained a 52.69Kb IMAGEMAP (see Fig.1) which, although graphically striking, required so much time to download that users might decide to quit the site.

Overall, the site received a score of 3.01. The overall evaluation of the site is shown in Figure 2, where it will be seen that the best result was achieved by *Content*, while the site's weak points were *Usability* and *Services*.

At the beginning of August 1999, redesign of the site was complete, and in September 1999 it was decided to repeat its evaluation. This second analysis showed that improvements had been made to *Location* and *Usability*, while the other items were as before. In particular, the site could be found even more rapidly[24] , while *Usability* had improved, mainly because the home page had been simplified and a site map had been added. The date of the site's last revision was still missing. There was the same number of broken links, which caused some problems when using the home and search links, and this slightly reduced the score for *Management* (Fig.3).

5. CONCLUSIONS

This paper has discussed a model for site design and evaluation. A first theoretical result is that the model has been validated on the basis of the principles of classical rhetoric. The results of its application were certainly positive. When applied to the Dolomiti Consortium, the model showed that it can be easily adapted to analysis of a specific web site, and that it can be used even by those with limited experience of web site evaluation. Finally, by highlighting the weaknesses of the site, it furnished the Consortium with useful suggestions for its redesign. The model 2QCV2Q is now being used experimentally to design an educational site to support university courses and to redesign the web site of a services company.

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NOTES

1 This study, entitled "Applications of IT to analysis of the tourism sector" is financed by the Department of Computer and Management Sciences of the University of Trento.

2 ENTER Web Award Committee: http://www.tis.co.at/enter

3 See http://www.vuw.ac.nz/agsmith/eveln/evaln.htm

4 By "site owner" we mean the organisation, company or person that invest money and time to develop and support the site.

5 http://www.clarence.com/home/htmlpoint/controllo.htm.

6 http://www.x-land.it/landis

7 Applications of object-oriented methods for the design of hypermedia are frequent in the literature on these software systems. See e.g. [3].

8 See the Rational site: http://www.rational.com/uml/index.html.

9 See for example the description in [9].

10 *Locus* and *argumentum* are interchangeable terms in Latin, classical and medieval terminology.

11 Some lists of loci comprise a further item: *facultas*, *Quibus adminiculis*?, or "with what means and devices".

12 Branding on the Web is different: see e.g. [7].

13 http://www.ferrari.it

14 http://www.mediasuk.org/no_p/magazine2.html.

15 This attribute is related to interactivity. See e.g. [1].

16 http://www.greyhound.com

17 A survey on e-commerce sites reports that consumers wait an average of 28 seconds for a page to download [10].

18 Copyright 1998 – Mercury Interactive Corporation, http://www.merintr.com.

19 Copyright 1998 – Tetranet Software Incorporated, http://www.tetranetsoftware.com.

20 Copyright 1996, 1998, CAST – Center for Applied Special Technology, http://www.cast.org.

21 See the Web Design Group site for a list of validators: http://www.htmlhelp.com/links/validator.html.

22 http://www.dolomitisuperski.com

23 For a complete analysis of the site, see [8].

24 A search with Altavista using the keywords 'skiing' and 'Dolomites' put the site in the first 4 places, with a total of 8 of the first 10 sites retrieved.

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