AN INTEGRATIVE APPROACH TO THE ASSESSMENT OF E-COMMERCE QUALITY

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ABSTRACT

WebQual is a method for assessing the quality of Web sites. The method has been developed iteratively through application in various domains, including Internet bookstores and Internet auction sites. In this paper we report on the application of a new version of WebQual to Internet bookstores: Amazon, BOL, and the Internet Bookshop. WebQual draws on previous work in three areas: Web site usability, information quality, and service interaction quality to provide a rounded framework for assessing e-commerce offerings. Although WebQual is grounded in the subjective impressions of Web site users, the data collected lends itself to quantitative analysis and the production of e-commerce metrics such as the WebQual Index. The reliability of the instrument is examined and core constructs of Web site quality identified using factor analysis. The role of WebQual in assessing an organization's e-commerce capability is discussed.

Keywords: Electronic commerce; Quality; Evaluation; Internet bookstores

1.   Introduction

A key challenge for e-commerce organizations is to understand customer requirements and to develop their Web presence and back-office operations accordingly. An organization with a Web site that is difficult to use and interact with will project a poor image on the Internet and weaken the organization's position. It is therefore important that an organization be able to make an assessment of the quality of their e-commerce offering, as perceived by their customers and in the context of the industry. In doing so, organizations can improve their offerings over time and benchmark against competitors and best practice in any industry.

This research utilizes the WebQual method to assess online bookshops. The WebQual instrument has been under development since the early part of 1998 and has evolved via a process of iterative refinement in different e-commerce and e-government domains. Previous applications of WebQual include UK business school Web sites (Barnes and Vidgen 2000), Internet bookshops (Barnes and Vidgen 2001a), small companies (Barnes and Vidgen 2001b), and online auction houses (Barnes and Vidgen 2001c). The method turns qualitative customer assessments into quantitative metrics that are useful for management decision-making. Typically, the tool allows comparisons to be made between organizations in the same industry or for the same organization over time.

The structure of the paper is as follows. In the next section we give the rationale and background to the development of WebQual. In section 3 the research design is described, including a review of the domain in which WebQual is deployed in this paper – Internet bookshops. Section four reports the data analysis and preliminary findings, which are then discussed and interpreted in section five. The last section provides a summary and makes recommendations for future work.

2.   The Provenance of WebQual

2.1   WebQual 1.0

The first version of the WebQual instrument was developed in the domain of UK business schools (Barnes and Vidgen 2000). The development methodology for the instrument was to use quality function deployment (QFD), which is a "structured and disciplined process that provides a means to identify and carry the voice of the customer through each stage of product and or service development and implementation" (Slabey 1990). The starting point for QFD is to articulate the "voice of the customer" and to this end we ran a quality workshop in August 1998 with six Masters students. Bossert (1991) recommends a three-stage process for a quality workshop: establish a single issue

for discussion; collect quality requirements and functions using post-it notes; and, use affinity grouping to gather requirements into categories that make sense to the customer. The single issue for discussion was: "What are the qualities of an excellent business school web-site?" Delegates worked individually writing out their ideas onto post-it notes and were encouraged to put down a brief phrase together with a longer sentence to explain the rationale for the proposed quality. The delegates were then allocated to two teams and asked to combine their qualities into affinity groups (a tree-structured list), initially working in silence to move the post-its around and creating headings as they felt appropriate. Finally, the two teams were brought back together to produce a single consolidated list of demanded qualities. By the end of the session we had collected fifty-four raw qualities which were structured hierarchically into affinity groupings.

From the raw qualities a pilot questionnaire with thirty-five questions was developed. This was completed by the six attendees of the workshop and used to refine the questions. One outcome of the pilot was a recognition that the questionnaire was too long – to answer thirty-five questions for each of four business school web-sites involves the respondent in 140 assessments, plus a further 35 assessments of the importance of each quality. Using the literature on information quality, particularly Bailey and Pearson (1983), Delone and McLean (1992), Strong et al. (1997), and looking carefully for overlap of qualities the questionnaire was reduced to a more manageable 24 questions. Wherever possible, we removed questions that referred too directly to characteristics, functions, or parts of the web-site, since these represent the supplier perspective rather than the subjective user experience.

2.2   WebQual 2.0

In applying WebQual to B2C Web sites it became clear that the interaction perspective of quality was largely missing from WebQual 1.0. Bitner et al. (1990, p. 72) adopt Shostack's (1985) definition of a service encounter as "a period of time during which a consumer directly interacts with a *service*" and note that these interactions need not be interpersonal - a service encounter can occur without a human interaction element. Bitner et al. (1990) also recognize that "many times that interaction *is* the service from the customer's point of view" (p. 71). We suggest that interaction quality is equally important to the success of e-businesses as it is to "bricks and mortar" organizations (and possibly more so given the removal of the interpersonal dimension). In WebQual 2.0 we therefore extended the interaction aspects by adapting and applying the work on service quality, chiefly SERVQUAL (Parasuraman 1985, 1988, 1995, Zeithaml et al. 1990, 1993) and IS SERVQUAL (Pitt et al. 1995, 1997, Kettinger and Lee 1997, Van Dyke et al. 1997), to a Web site evaluation of online bookshops. As with WebQual 1.0, quality workshops were conducted to elicit customer requirements, this time in the domain of Internet bookshops (see Barnes and Vidgen 2001a for a full account).

2.3   WebQual 3.0

While WebQual 1.0 was strong on information quality, it was less strong on service interaction. Similarly, where WebQual 2.0 emphasized interaction quality it lost some of the information quality richness of WebQual 1.0. Both instruments contained a range of qualities concerned with the Web site as a software artefact. In reviewing the instruments we found that all of the qualities could be categorized into three distinct areas: site quality, information quality, and service interaction quality. This new version of WebQual (3.0) was tested in the domain of online auctions (Barnes and Vidgen 2001c).

2.4   WebQual 4.0

Analysis of the results of WebQual 3.0 led to the identification of three dimensions of e-commerce Web site quality: usability, information quality, and service interaction quality. The core qualities of WebQual 4.0 are shown in Table 1, along with primary and secondary literature support. Usability has replaced site quality in WebQual version 4.0 because it keeps the emphasis on the user and their perceptions rather than on the designer and the site as simply a context-free software artefact. The term usability also reflects better on the level of abstraction of the other two dimensions of WebQual - information and service interaction. In WebQual 4.0 the usability dimension draws from literature in the field of human computer interaction (Davis 1989, 1993, Nielsen 1993) and more latterly Web usability (Nielsen 1999, 2000a, Spool et al. 1999). Usability is concerned with the pragmatics of how a user perceives and interacts with a Web site: is it easy to navigate? Is the design appropriate to the type of site? It is not, in the first instance, concerned with design principles such as the use of frames or the percentage of white space, although these are concerns for the Web site designer who is charged with improving usability.

Thus, WebQual has evolved using quality workshops, factor analysis to identify question groupings, and literature from three core research areas: information quality from mainstream IS research; service interaction quality from marketing (as well as some IS and e-commerce sources); and usability from human-computer interaction. We ran quality workshops at every stage of WebQual's development to ensure that the qualities were relevant, particularly where they relate to pre-Internet literature and new industries. We also found some items that are not adequately captured in the extant research - in particular, those questions in Table 1 that do not have a primary source. In this case, emphasis was placed on providing secondary literature support for these qualities.

Table 1: The provenance of WebQual 4.0

Category	WebQual 4.0 Questions	Illustrative Support for Questions
Usability	1. I find the site easy to learn to operate	Bailey and Pearson 1983[2], Davis et al. 1989[2], Davis 1989[2], 1993[1], Ventakesh and Davis 2000[2]
	2. My interaction with the site is clear and understandable	Davis et al. 1989[2], Davis 1989[2], 1993[1], Shneiderman 1998[2], Ventakesh and Davis 2000[2]
	3. I find the site easy to navigate	Eighmey 1997[2], Levi and Conrad 1996[2], Nielsen 1999[2], 2000a[2], Spool 1999[2]
	4. I find the site easy to use	Davis et al. 1989[2], Davis 1989[2], 1993[1], Ventakesh and Davis 2000[2], Nielsen 1993[2], 1999[2], 2000a[2]
	5. The site has an attractive appearance	Nielsen 2000a[2], Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2]
	6. The design is appropriate to the type of site	From WebQual workshops; no strong support, but tangential to research on customer expectations of appearance, e.g. Zeithaml et al. 1990
	7. The site conveys a sense of competency	Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2], Zeithaml et al. 1988[2], 1990[2], 1993[2]
	8. The site creates a positive experience for me	Eighmey 1997[2], Moon and Kim 2001[2], Nielsen 2000a[2], White and Manning 1998[2]
Information	9. Provides accurate information	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	10. Provides believable information	Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	11. Provides timely information	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	12. Provides relevant information	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	13. Provides easy to understand information	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	14. Provides information at the right level of detail	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	15. Presents the information in an appropriate format	Bailey and Pearson 1983[1], Chau et al. 2000[2], DeLone and McLean, 1992[2]
Service Interaction	16. Has a good reputation	Aaker 1991[2], Aaker and Joachimsthaler 2000[2], Akshay and Monroe 1957[2], Cuningham 1966[2], Nielsen 1999[2]
	17 It feels safe to complete transactions	Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2], Zeithaml et al. 1988[2], 1990[2], 1993[2]
	18. My personal information feels secure	Clark 1999[2], Cranor 1999[2], Goodwin 1991[2], Hoffman et al. 1999[2], Wang et al. 1998[2]
	19. Creates a sense of personalization	Gilmore and Pine 2000[2], McKenna 2000[2], Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2], Schubert and Selz 1997[2], Zeithaml et al. 1988[2], 1990[2], 1993[2,]
	20. Conveys a sense of community	Armstrong and Hagel 1996[2], Chang et al. 1998[2], Hagel and Armstrong 1997[2], Preece 2000[2], Rheingold 1993[2], Schubert and Selz 1997[2]
	21. Makes it easy to communicate with the organization	Bitner et al. 2000[2], Jarvenpaa et al. 2000[2], Hoffman et al. 1999[2], Nielsen 2000a[2]
	22. I feel confident that goods/services will be delivered as promised	Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2], Zeithaml et al. 1988[2], 1990[2], 1993[2]

[1] denotes a primary source for a question - reworded for WebQual 4.0
[2] denotes a secondary influence for the inclusion of a question in WebQual 4.0

3.   Research Methodology and Research Domain
3.1   The sites to be evaluated: Amazon, BOL and Internet Bookshop

WebQual 4.0 was applied to UK Internet bookshops. Buying books over the Internet is one of the early applications of B2C e-commerce and has matured to become relatively stable, at least in Internet terms, with 5.4% of total global book sales in 1999 (Mintel 2000). Further, the growth of online bookstores and the role of players such as Amazon – with more than half of the online book market - is well documented (Chircu and Kauffman 2001, Ghemawat 1998, Kalakota and Robinson 1999). The bookshops chosen for the research were Amazon, Bertelsmann Online (BOL) and the Internet Bookshop (IBS). These are currently considered the largest players in the UK Internet bookstore market (Mintel 2000).

Amazon.com was launched in July 1995. However, although Amazon.com is accessible from all over the world, in the last few years the company has also established a localized presence in other international markets – including the UK, Germany, France and Japan - to comply with publishers' territorial rights while minimizing shipping costs. Amazon established a UK presence in 1998, amazon.co.uk, with headquarters in Slough, a town 25 miles west of London. It had an estimated annual turnover of £45 million during 1999 – 4.1% of the UK book market (Publishing News 2000). Owned by the media conglomerate Bertlesmann AG, BOL (Bertelsmann Online) is the newest of the sites examined – launched in 1999. The launch of BOL follows Bertelsmann's acquisition of a 50% share in US-based Barnes and Noble's online book retailing subsidiary BarnesandNoble.com for $200 million in October 1998 (Mintel 2000). Barnes and Noble is one of the World's largest booksellers with around 1000 bookstores. The Internet Bookshop was established in 1993, making it one of the UK's longest-established Internet bookstores. The owner of the IBS Web site, WH Smith, is a traditional UK high-street business, selling newspapers, books, music and stationery. WH Smith have an estimated £330 million (19.4%) of the UK book market (Publishing News 2000) and is estimated to be second for Internet sales behind Amazon.co.uk (Mintel 2000), although there are no accurate figures for its Web operations.

3.2   Research design

There are a number of ways of evaluating the quality of a Web site, including competitive analysis, scenarios, inspection, log analysis, and online questionnaires (Cunliffe 2000). The WebQual approach is to use an online questionnaire targeted at real users of an e-commerce offering. The use of students as experimental subjects can lead to results that are artificial, particularly where students are asked to perform a task of which they have little experience. However, in the case of Internet bookstores the students and staff of a university make excellent subjects given that both groups buy books as a matter of course and have considerable experience of this area of e-commerce (Publishers Association 2000). We were therefore comfortable that the target population would be representative of online bookstore customers and constitute a valuable market segment for book retailers.

In previous WebQual trials, there has been a strong element of competitive analysis through the benchmarking of multiple sites in a single questionnaire; for example, each respondent was asked to evaluate four business school sites in WebQual 1.0. This approach made it relatively easy for the respondent to benchmark sites against their competitors. However, in this research we take a slightly different approach by using independent samples for the evaluation of each Web site to remove any bias from the process of multiple evaluation. Although asking each respondent to evaluate a single site makes less work for the respondent, it also increases the number of responses needed for suitable analysis. A requirement of the research design was to collect sufficient data to conduct a factor analysis to test our WebQual 4.0 categorization of questions into usability, information quality and service interaction quality and to see what new clusters might emerge. It is generally accepted that factor analysis requires a minimum of 100-200 respondents (Kline 1994, Guilford 1954). Our experience with previous trials of WebQual showed that a considerable incentive would be needed to attract sufficient responses for a reliable statistical analysis to be performed. We considered that three sites would be sufficient for inter-site comparison purposes (the three main competitors in the UK market) and that more sites could not be evaluated without the risk of there being insufficient sample sizes. A first prize of £250 cash and four runners-up prizes of £25 of e-book tokens were offered as incentives, selected at random from the final sample.

The questionnaire was administered online. The URL of the survey was posted on the University's home page and promoted through posters on notice boards, e-mail, and announcements at lectures. Respondents were directed to the start page for the survey, where they could read a set of brief instructions and then click the "start" button. This button opened a second window that was used to collect questionnaire data (Figure 1). By clicking on the question number the user could see a dictionary entry for that item - a paragraph of text expanding on the quality and giving examples as appropriate. A random number was generated to pick which of the three sites would be presented to any given respondent. Questionnaires were checked online prior to submission to ensure that valid responses had been entered for all questions (an option "not applicable" was included to ensure that responses were not forced). To ensure a deeper level of commitment to the evaluation of the site the respondents were asked to find a book on the

site that they would like as a runners-up prize. Respondents were asked to supply the title, price, and delivery cost. Using the terminology of Spool et al. (1999), these are 'facts' that the respondent is asked to determine, which made it more likely that a respondent would engage in searching and navigating the site. Furthermore, in setting a task we aimed to maintain a more 'natural' and representative flow of interaction between the user and the Web site.

Figure 1: The WebQual interface

Respondents were asked to evaluate each of the sites using a 7-point scale (as in SERVQUAL; see Zeithaml et al 1990) where the anchors are 1 = "strongly disagree" and 7 = "strongly agree". The importance scale was anchored with 1 = "least important" and 7 = "most important" (as recommended in the QFD literature; see King 1989). All responses were received between April 2 and April 13 2001. The online questionnaire responses were written directly to a file, filtered to check for duplicates, and converted into a form usable in SPSS (a statistical software package) and Microsoft Excel. This resulted in 376 usable responses: 143 for Amazon, 117 for BOL, and 116 for the Internet Bookshop.

4.   Data Analysis
This section reports on the results of the survey, using a variety of statistical methods for data analysis. These provide an analysis of the particular areas of strengths and weaknesses for the Web sites.

4.1   Information on the sample
The demographic data collected shows that a large proportion of the sample is experienced in buying books on the Internet – a total of nearly three-fifths of total respondents. The sample is also very experienced in Internet use with a high intensity of use; more than three-quarters of the sample have used the Internet for in excess of two years with two-thirds using it more than once per day. Of the different bookstores evaluated, the market leader – Amazon.co.uk – was the most familiar for previous purchases with BOL and IBS some way behind (46.9% compared with 9.4% and 4.3% respectively). Similarly, the tendency to buy while evaluating was greater for Amazon than BOL or IBS (8.4% for Amazon compared to 4.3% for both BOL and IBS). The median for monthly book expenditure was £10 to £20. In terms of demographics, there are some clear patterns in the data. Nearly 90% of the respondents are students, and 95% are 35 years of age or less. Just over two-fifths of the sample is female – similar to the UK average of 39.1% (Nielsen Net Ratings 2000).

4.2   Summary of questionnaire data

The data summary provided in Table 2 shows a number of items for discussion. The columns represent four data subsets based on the 376 responses: the importance rating for each question and the per question perception ratings for each of the three online bookshops. Three summary items are shown in the table for each question and subset: the mean, standard error and standard deviation.

Referring to Table 2, there are some interesting patterns in the data. In terms of the importance ratings for the individual questions, there are some useful groupings to note. Those questions considered most important by the respondents - as indicated by means above the upper quartile of 6.02 - are heavily tied to information accuracy, usability and issues of trust. Here we find, in descending order of importance, questions 9, 17, 22, 18, 3 and 4. Such questions concern security and reliability regarding completion of transactions, receipt of goods and personal information, accuracy of content, as well as ease of site use and navigation. Conversely, when examining those items considered least important - below the lower quartile of 5.00 - we find a quite different variety of questions. Specifically, questions 20, 19, 5, 8, 6 and 21 are in ascending order of importance. This group revolves around empathy with the user (communication, community and personalization), as well as site design issues (site experience, appropriateness of design and aesthetics). The remaining questions fall somewhere in between these two groupings and the median is 5.69.

Table 2: Means and standard deviations for the questionnaire data (n=376)

No.	Description	Importance			Amazon			BOL			IBS		
		Mean	St. Err.	St. Dev.	Mean	St. Err.	St. Dev.	Mean	St. Err.	St. Dev.	Mean	St. Err.	St. Dev.
1	I find the site easy to learn to operate	5.96	0.10	1.43	5.73	0.09	1.10	5.45	0.13	1.41	5.58	0.12	1.35
2	My interaction with the site is clear and understandable	5.82	0.10	1.41	5.49	0.10	1.25	5.29	0.12	1.25	5.30	0.12	1.33
3	I find the site easy to navigate	6.06	0.08	1.34	5.55	0.11	1.32	5.26	0.13	1.39	5.46	0.13	1.40
4	I find the site easy to use	6.03	0.08	1.37	5.69	0.10	1.21	5.51	0.12	1.35	5.50	0.13	1.36
5	The site has an attractive appearance	4.55	0.13	1.52	4.84	0.11	1.33	4.66	0.12	1.25	4.66	0.12	1.26
6	The design is appropriate to the type of site	4.74	0.13	1.60	5.23	0.13	1.51	5.13	0.11	1.24	4.90	0.14	1.47
7	The site conveys a sense of competency	5.35	0.11	1.55	5.63	0.11	1.29	5.17	0.12	1.27	4.99	0.16	1.69
8	The site creates a positive experience for me	4.58	0.15	1.93	4.82	0.13	1.61	4.44	0.13	1.44	4.43	0.15	1.59
9	Provides accurate information	6.21	0.08	1.40	5.57	0.13	1.55	4.99	0.17	1.85	5.34	0.16	1.69
10	Provides believable information	5.71	0.12	1.70	5.64	0.12	1.48	5.21	0.15	1.67	5.34	0.16	1.70
11	Provides timely information	5.19	0.13	1.88	5.23	0.15	1.73	4.44	0.18	1.95	4.86	0.18	1.95
12	Provides relevant information	5.73	0.11	1.55	5.46	0.12	1.47	5.00	0.15	1.57	5.22	0.15	1.57
13	Provides easy to understand information	5.78	0.11	1.47	5.60	0.11	1.32	5.41	0.12	1.29	5.59	0.12	1.25
14	Provides information at the right level of detail	5.66	0.10	1.36	5.29	0.12	1.44	4.53	0.14	1.47	5.08	0.14	1.47
15	Presents the information in an appropriate format	5.48	0.11	1.41	5.37	0.11	1.29	5.09	0.11	1.21	5.19	0.12	1.24
16	Has a good reputation	5.27	0.13	2.10	6.06	0.13	1.56	3.06	0.23	2.51	2.78	0.24	2.54
17	It feels safe to complete transactions	6.21	0.07	1.73	5.36	0.16	1.86	3.68	0.23	2.44	3.72	0.23	2.46
18	My personal information feels secure	6.13	0.10	1.87	5.07	0.16	1.93	3.59	0.22	2.43	3.75	0.22	2.36
19	Creates a sense of personalization	4.26	0.16	1.92	4.80	0.15	1.82	3.58	0.18	1.90	3.72	0.18	1.90
20	Conveys a sense of community	3.15	0.17	1.94	3.44	0.16	1.88	3.22	0.16	1.75	2.85	0.17	1.79
21	Makes it easy to communicate with the organization	4.94	0.15	1.85	4.33	0.17	2.00	3.91	0.19	2.03	4.32	0.19	2.04
22	I feel confident that goods/services will be delivered as promised	6.17	0.10	1.63	5.59	0.15	1.85	4.54	0.17	1.87	4.72	0.18	1.90

The results suggest that there are a number of priorities demanded from online bookshops by Web site users. In particular, customers are most concerned with ease of site use, finding accurate information, and being able to reliably transact and receive goods. Intuitively, these are the features one would expect as critical to an e-commerce Web site. In relative terms, there seems to be much less emphasis placed upon technical issues, which appears to be a general trend (Dutta and Segev 2001). Interestingly though, softer qualities such as community, personalization and site experience rate quite low in importance. This is likely to be due, in part, to slow adoption and acceptance of some of these ideas in this commercial domain (Chang et al. 1998). Some explanations are discussed below in section 4.

There are some differences in the standard deviations of ratings for particular questions and sites, although overall, the patterns are quite similar. For example, the respondents appeared more certain about harder service interaction qualities (questions 1 to 4) and information qualities (questions 9 to 10 and 12 to 15), than about softer qualities such as reputation (question 16) and empathy (questions 19 to 21). The standard deviations and errors for the Amazon site appear lower overall than the other sites.

Turning to the results for the ratings of individual sites, we find some very stark contrasts. The unweighted averages in Table 3 show very clearly that the Amazon UK site ranks well above its two contemporaries. The site scored consistently higher than the other two sites for all items – with the biggest lead for reputation (3 points) and the smallest for ease of communication and ease of understanding information (0.1 points). The other two sites varied in their rankings, although IBS averaged higher than BOL for all but 7 questions.

4.3 WebQual Index

The weighted results shown in Table 3 serve to accentuate the differences indicated above in the direction of user priorities. Each respondent's site rating for a question is multiplied by the importance attached to it by the individual – Table 3 displays the average of weighted scores for each site. Again, Amazon appears to rank highest, although there is more competition in the rankings between BOL and IBS. The total weighted score give some indication of this.

However, the weighted scores make it difficult to give an overall benchmark for the sites. One way to achieve this is to index the total weighted score for a site against the total possible score. The highest possible score that a site can achieve is the mean importance from Table 2 multiplied by 7, the maximum rating for a question (the maximum score column in Table 3). BOL, for example, achieves a score of 565.00 of a maximum possible 832.91, giving it a WebQual Index (WQI) of 0.68, or 68%. Table 3 also shows the WQI for the individual questions. Overall, Amazon is benchmarked well above the other two cyber-bookstores, with an overall WQI of 0.82. IBS follows with a WQI of 0.70, whilst BOL is close behind at 0.68.

Table 3: Weighted scores and the WebQual index (n=376)

No.	Description	Max. Score	Amazon		BOL		IBS	
			Wgt. Score	WQI	Wgt. Score	WQI	Wgt. Score	WQI
1	I find the site easy to learn to operate	41.74	35.57	0.85	32.44	0.78	33.84	0.81
2	My interaction with the site is clear and understandable	40.73	33.29	0.82	30.62	0.75	31.99	0.79
3	I find the site easy to navigate	42.45	35.10	0.83	32.53	0.77	33.25	0.78
4	I find the site easy to use	42.22	36.20	0.86	33.27	0.79	33.61	0.80
5	The site has an attractive appearance	31.85	23.08	0.72	20.85	0.65	21.85	0.69
6	The design is appropriate to the type of site	33.21	27.31	0.82	24.67	0.74	23.08	0.69
7	The site conveys a sense of competency	37.42	32.39	0.87	27.95	0.75	28.03	0.75
8	The site creates a positive experience for me	32.08	25.15	0.78	21.32	0.66	21.02	0.66
9	Provides accurate information	43.49	36.62	0.84	31.41	0.72	33.73	0.78
10	Provides believable information	39.97	35.30	0.88	30.07	0.75	31.28	0.78
11	Provides timely information	36.30	30.38	0.84	23.78	0.65	27.77	0.76
12	Provides relevant information	40.12	33.46	0.83	29.06	0.72	31.29	0.78
13	Provides easy to understand information	40.44	34.17	0.84	31.59	0.78	33.29	0.82
14	Provides information at the right level of detail	39.64	31.16	0.79	25.84	0.65	28.95	0.73
15	Presents the information in an appropriate format	38.33	30.74	0.80	28.68	0.75	29.13	0.76
16	Has a good reputation	36.88	36.73	1.00	17.16	0.47	15.19	0.41
17	It feels safe to complete transactions	43.47	36.47	0.84	23.63	0.54	23.07	0.53
18	My personal information feels secure	42.93	34.28	0.80	22.54	0.52	23.86	0.56
19	Creates a sense of personalization	29.79	23.64	0.79	16.10	0.54	16.59	0.56
20	Conveys a sense of community	22.04	13.17	0.60	12.17	0.55	10.27	0.47
21	Makes it easy to communicate with the organization	34.59	23.88	0.69	20.33	0.59	23.28	0.67
22	I feel confident that goods/services will be delivered as promised	43.21	37.24	0.86	28.98	0.67	29.82	0.69
	TOTALS:	832.91	685.32	0.82	565.00	0.68	584.21	0.70

Perhaps more interesting is some conceptual assessment of how the Web sites differ in quality. For this, we need to move beyond the scores and indices of individual questions towards a set of meaningful and reliable sub-groupings. To this end, the next subsection derives a set of subcategories that are the applied to the analysis.

4.4   Scale validity and reliability

To better facilitate comparison between the Web sites the research attempted to establish a number of question subgroupings. In this sense, the generation of subcategories is relatively similar to the work associated with SERVQUAL (Zeithaml et al. 1990). As a starting point, and to establish that the qualities can be disentangled and are not part of a single scale, a factor analysis was conducted on the data. In particular, we were interested in testing the construct validity of the usability, information quality and service interaction quality groupings presented in Table 1.

Factor analysis was conducted on the set of 376 cases. The Varimax factor rotation converged in 8 iterations and a relatively simple factor structure emerged. Five factors are shown quite clearly in the principal components analysis – as given in Table 4. Factor loadings in excess of 0.7 can be considered "excellent" (Comrey 1973). The WebQual groupings from Table 1 are confirmed in the data and demonstrate nomological and discriminant validity. Specifically, all the information qualities load as a single factor, whilst usability and service interaction qualities both load as two sets of factors. Usability quality consists of "usability" (questions 1 to 4) and "design" (questions 5 to 8). Service interaction quality is made up of "trust" (questions 16, 17, 18 and 22) and "empathy" (questions 19 to 21). The usability and service interaction constructs each miss one quality – questions 7 and 16 have factor loadings less than the 0.55 cutoff point. However, the factor loadings for both questions can be considered near misses (and still significant at the 5% level) and consequently we have retained them in the analysis and presentation of results. These questions have loaded in other tests of WebQual.

Table 4: Exploratory factor analysis (Principal Components method with Varimax rotation; loadings ≥ 0.55[*])

	Component				
	1	2	3	4	5
Q1		.780			
Q2		.789			
Q3		.794			
Q4		.777			
Q5				.713	
Q6				.726	
Q7					
Q8				.576	
Q9	.702				
Q10	.711				
Q11	.756				
Q12	.706				
Q13	.599				
Q14	.608				
Q15	.594				
Q16			.607		
Q17			.887		
Q18			.862		
Q19					.688
Q20					.882
Q21					
Q22			.684		

[*] The cutoff point for loadings is .01 significance, which is determined by calculating $2.58/\sqrt{n}$, where n is the number of items in the questionnaire (Pitt et al. 1995)

Based on the emerging factor structure, Cronbach's alpha (Cronbach 1970) was computed to assess reliabilities of all scales and subscales. Table 5 shows the alpha reliability statistics for each scale as computed from the data, both for each site and as a mean of site scores. All of the alpha scores for the three constructs are in the range of

acceptability (Nunnally 1978). Moreover, the alpha scores of all subcategories are also acceptable – with one exception; "empathy" falls below the 0.7 mark on the IBS data set.

Table 5: Reliability analysis for constructs

Scale	Questions	Amazon α	BOL α	IBS α	Average α
Usability	*1 to 8*	*0.88*	*0.88*	*0.87*	*0.88*
Usability	1 to 4	0.88	0.89	0.93	0.90
Design	5 to 8	0.78	0.76	0.72	0.75
Information quality	*9 to 15*	*0.89*	*0.88*	*0.90*	*0.89*
Information	9 to 15	0.89	0.88	0.90	0.89
Service Interaction quality	*16 to 22*	*0.82*	*0.85*	*0.76*	*0.81*
Trust	16 to18 and 22	0.83	0.83	0.75	0.80
Empathy	19 to 21	0.72	0.74	0.64	0.70
OVERALL	*1 to 22*	*0.93*	*0.93*	*0.92*	*0.93*

To summarize, there appear to be five factors in the WebQual instrument. These factors can be grouped into three main components that confirm earlier research:

- *Usability*. Qualities associated with "site design" and "usability"; for example, appearance, ease of use and navigation, and the image conveyed to the user.
- *Information quality*. The quality of the content of the site: the suitability of the information for the user's purposes, e.g. accuracy, format and relevancy.
- *Service interaction quality*. The quality of the service interaction experienced by users as they delve deeper into the site, embodied by "trust" and "empathy"; for example, issues of transaction and information security, product delivery, personalization and communication with the site owner.

As we shall see in the next section, these provide some useful insight into the company data.

4.5 Site analysis using question subcategories

By utilizing the framework of categories examined in the last section, we are able to build a profile of the qualities of an individual Web site that makes it easy to compare with its rivals. Thus, we may examine why some sites fared better than others on the WebQual Index.
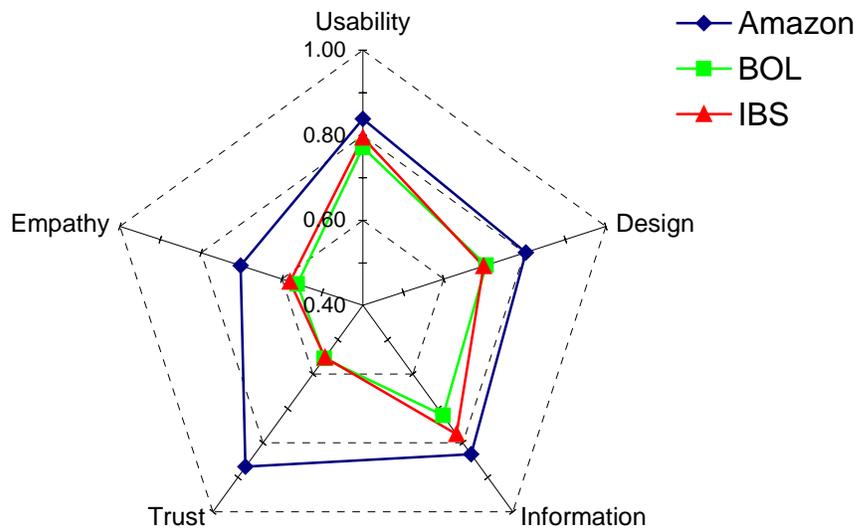

Figure 2: Radar chart of WebQual 4.0 subcategories for the three Web sites

As a starting point, the data was summarized around the five questionnaire subcategories. Then, and similarly to the WebQual Index in Table 3, the total score for each category was indexed against the maximum score (based on the importance ratings for questions multiplied by 7). Figure 2 is the result, which rates the three Web sites using these criteria. Note that the scale has been restricted to values between 0.4 and 1.0 to allow for clearer comparison.

Figure 2 demonstrates very clearly that the Amazon UK site stands "head and shoulders" above the two rivals. The indices for the Amazon subcategories make a clear circle around the other two sites, with Trust rating particularly well – more than 30 points in excess of the two competitors. Other areas are less strong, in relative terms, although still 4 to 12 points ahead of the nearest rival. Empathy had the lowest WQI for Amazon (although still 12 points above IBS), with other categories somewhere in between. Some explanations for these results are discussed in section 4.

The scores of the two other bookshops are very close, with IBS edging only slightly ahead of BOL for three of the subcategories. Information quality presents the largest discrepancy – a lead of 5 points for IBS – with empathy and usability both 2 points ahead. The remaining categories contain almost equal scores.

5.   Discussion

WebQual is a useful diagnostic tool for assessing the perceived quality of an organization's e-commerce operation. The iterative process of development and integration of the literature has helped to build a degree of external validity in the instrument. It is particularly powerful when used to provide a benchmark against competitor organizations and can also be applied longitudinally to evaluate the impact of e-commerce development activities. However, despite providing a valuable profile of e-commerce quality, WebQual does not provide prescriptive advice concerning how an organization might improve its e-commerce offering. In this section we consider the implications of the results of the WebQual survey.

The survey indicates that the differences in usability between the three sites are relatively small, suggesting that once a basic level of usability is achieved then the design of the Web site is unlikely to be a differentiating competitive factor. Dutta and Segev (2001) argue that, generally, less emphasis is being placed on the technical aspects of Web sites. With regard to design, the difference is more marked, indicating that the design of the Amazon site is preferred, although this may be due in part to respondents being more likely to be familiar with the Amazon site. It is a relatively straightforward task for an organization to benchmark the usability of its Web site, for example by holding a usability workshop (Nielsen 1993, Spool et al. 1999). Indeed, Nielsen (2000b) goes as far as to argue that five users are enough to evaluate the usability of a site.

Respondents rated "accurate information" as the most important item in the WebQual instrument. This suggests that e-commerce businesses need to pay attention to the content of their Web sites. Lack of control over content is evident when, for example, organizations do not remove special offers that have expired (a Web content management system should remove documents automatically based on an expiry date). However, managing information quality is likely to be rather more difficult than improving Web usability. Web content management is becoming a major issue for organizations; Ovum (2000) predict that the market for Web content management tools will grow from the 1999 level of $475 million to $5.3 billion by 2004. Web content management is concerned with the life cycle of Web documents, from creation through Web publishing to destruction. Whereas usability can be evaluated quickly, information quality is likely to require an enterprise-wide approach that addresses all the sources of content, encompassing authors, existing systems and databases.

Whereas usability and information quality might be addressed largely through internal changes, service interaction quality requires a stronger external perspective. The greatest differentiator of the sites is "trust", where Amazon is a long way ahead of its competitors. Indeed, "trust" appears to be a key aspect of competition in e-commerce (Clarke 1999, Cranor 1999, Gefen 2000, Jarvenpaa et al. 2000, McKnight et al. 1998). Notwithstanding, the concept of "trust" has a degree of ambiguity; research has discovered a variety of definitions of trust, including those related to benevolence, integrity, competence and predictability, amongst others (Manchala 2000, McKnight and Chervany 2001). However, these ideas surface comfortably through the questionnaire items. Interestingly, of the four questions that comprise "trust", three of the questions were rated as second, third, and fourth most important by respondents (only "accurate information" rated more highly in terms of customer importance).

It is unlikely that excellent Web site design and judicious use of new technology will increase the perception of trust by customers, since trust is affected by external factors, such as the strength of the brand, the customer's previous experiences, and the whole range of communications generated by the brand-owner, the media, and word-of-mouth (Aaker and Joachimsthaler 2000, Briggs and Hollis 1997, Gilmore and Pine 2000, McKenna 2000). There are Web site design implications for "trust", such as making sure that the privacy policy is visible, and displaying the logo of a third party for accreditation of security mechanisms (Benassi 1999, Hoffman et al. 1999). However, given Amazon's first-mover advantage and the switching costs incurred by customers in moving to a competitor,

BOL and the Internet Bookshop need to go further than Web site design considerations and offer something that distinguishes them from Amazon. In the case of the Internet Bookshop this might involve integration of online activity with the physical high-street network of its owner, WH Smith, and for BOL with its partner Barnes and Noble (Chircu and Kauffmann 2001).

To improve service interaction quality an organization will need to both integrate its front office operations - Web-based or otherwise - with its back office systems (Zeithaml et al. 1988), and integrate e-marketing with traditional marketing and customer relationship management activities. Consequently, established organizations with successful e-commerce offerings may tend to be mature users who have embraced the Internet wholeheartedly rather than as a bolt-on addition to their current organizational form, i.e., they pursue advanced levels of process integration. For example, the loss of traditional interpersonal elements in the move to cyberspace has implications for the removal of physical surroundings (Bitner 1990) and service employees (Hartline and Ferrell 1996), while virtual environments and intelligent agents can present interesting alternatives (Maes et al. 1999).

6.   Summary and Conclusions

WebQual is a method for assessing the quality of an organization's e-commerce offering. The WebQual Index gives an overall rating of an e-commerce Web site that is based on customer perceptions of quality weighted by importance. The analysis of the data set identified five factors: usability, design, information, trust, and empathy. These five factors map to the three dimensions of WebQual 4.0: usability (usability and design), information quality (information), and service interaction quality (trust and empathy). Organizations can address these three dimensions of Web site quality through Web site design, Web content management, and process integration respectively. Three Internet bookstores were evaluated – Amazon, BOL, and the Internet Bookstore – and analysis of the survey showed Amazon to be perceived as better in all three dimensions, and particularly so with regard to "trust", which is part of service interaction quality. Given that "trust" was the most highly rated factor in terms of customer importance, this has considerable implications for the presentation and communication of e-commerce offerings – both online and via traditional channels; a considerable body of extant research suggests that "trust" is likely to be a key differentiator of future "winners" and "losers" in e-commerce (Jarvenpaa et al. 2000, McKnight et al. 1998, Wang et al. 1998) and "trust building" has become a major focus for concern (Aaker and Joachimsthaler 2000, Briggs and Hollis 1997, Hoffman et al. 1999).

Future development of the WebQual approach includes longitudinal studies, Web site design characteristics, and testing in further domains. The WebQual 4.0 instrument was designed to ensure that all the questions could be answered without having completed the entire purchasing process. Although this approach gives an indication of user perceptions, it does not take into account lifecycle aspects of service quality. We therefore intend to follow up the WebQual survey with a longitudinal study of students and staff at Bath who have made purchases from online bookstores in order to make a fuller assessment of service quality. This will involve a questionnaire that looks at the delivery, after-sales service, and customer relationship management aspects of each of the bookshop's e-commerce offerings. Further work with WebQual will consider how to use the results of the survey from the perspective of the supplier. For example, with regard to usability this will involve looking at design characteristics of Web sites (Nielsen 2000a). Finally, we recognize that WebQual needs to be tested in different domains, such as the public sector and e-Government, and on applications with higher degrees of complexity (e.g., online tax filing) for it to be validated as a more general assessment of Web quality.

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AN INTEGRATIVE APPROACH TO THE ASSESSMENT OF E-COMMERCE QUALITY

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ABSTRACT

WebQual is a method for assessing the quality of Web sites. The method has been developed iteratively through application in various domains, including Internet bookstores and Internet auction sites. In the next section we give the rationale and background to the development of WebQual. In section 3 the research design is described, including a review of the domain in which WebQual is deployed in this paper – Internet bookshops.

This approach made it relatively easy for the respondent to benchmark sites against their competitors. However, in this research we take a slightly different approach by using independent samples for the evaluation of each Web site to remove any bias from the process of multiple evaluation. Although asking each respondent to evaluate a single site makes less work for the respondent, it also increases the number of responses needed for suitable analysis.

Keywords: Electronic commerce; Quality; Evaluation; Internet bookstores

1. Introduction

A key challenge for e-commerce organizations is to understand customer requirements and to develop their Web presence and back-office operations accordingly. An organization with a Web site that is difficult to use and interact with will project a poor image on the Internet and weaken the organization s position. It is therefore important that an organization be able to make an assessment of the quality of their e-commerce offering, as perceived by their customers and in the context of the industry. In doin