

Assessing the quality of auction web sites

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Abstract

WebQual is an instrument for assessing the quality of Internet sites from the perspective of the customer. Earlier versions of WebQual focused on information and interaction quality. This paper reports on a new version of WebQual that incorporates three quality dimensions: information quality, interaction quality, and site design quality. WebQual is applied in the domain of Internet auctions and the results used to assess the reliability of the instrument for assessing the quality of web sites. Three auction sites are evaluated: Amazon, eBay, and QXL through an intervention that involves buying and selling at auction. The results of the intervention are analyzed quantitatively to assess the validity of the WebQual instrument and supplemented by qualitative data that is used to consider the relative merits of the three sites evaluated.

1 Introduction

Internet web sites are a fast growing and significant business innovation. The business to consumer (B2C) market has expanded rapidly, as has the consumer to consumer (C2C) market, where community and Internet auction sites have played a large part. The business to business (B2B) market is expected to be a major growth area for e-commerce over the next few years

fuelled in part by dynamic pricing mechanisms, such as auctions. Forrester (<http://www.forrester.com>) predict a doubling of growth in B2B applications between 1999 and 2003 with B2B turnover reaching \$843 billion (against a B2C prediction of \$76 billion). To be successful in the e-commerce marketplace organizations will need to provide high quality web sites that attract and retain users. For every Internet innovation there will be numerous followers who can and will copy the site's functionality and quickly erode the first mover advantage of the originator. For example, the UK-based Internet Bookshop was established in 1994, but has failed to make significant headway and is now having to compete with the UK-based arm of Amazon. An organization with a web site that is difficult to use and difficult to do business on will project a poor image on the Internet and weaken the organization's competitive position. It is therefore important that an organization be able to make an assessment of the quality of their web site, as perceived by their customers and in the context of the competition in their industry.

WebQual is an instrument for assessing user perceptions of the quality of web sites. Previous applications of WebQual include UK Business School sites, Internet bookshops, and a longitudinal study of a small to medium sized enterprise in the market intelligence sector. This allows comparisons to be made between organizations in the same industry or for the same organization over time. When looking at competing organizations it is necessary to investigate a domain, such as online bookstores. One business model that is receiving widespread attention is the Internet-based auction. Internet auctions can be used in the B2C, B2B, and C2C domains. Currently, C2C auction sites are reaching maturity, with eBay (<http://www.ebay.com>) being a particularly well-known example. In this paper we describe how WebQual was used to evaluate the quality of three auction sites: Amazon, eBay, and QXL. These sites are in direct competition for the European online auction market and it is possible that the quality of their web sites will

prove to be a source of competitive advantage. The primary aim of the paper is to evaluate the usefulness and validity of the WebQual instrument as a generic tool for the assessment of web site quality. However, the application of the instrument in the domain of online auctions means that a secondary outcome of the research is an insight into industry competitiveness with respect to the quality of the auction sites.

The structure of the paper is as follows. In the next section we give the rationale and background to the development of WebQual. In the third section we review the domain in which WebQual is deployed – Internet auctions. In the fourth section we describe the research design and in the fifth section we report the findings. In section six we reflect on the usefulness of WebQual. The last section draws conclusions and makes recommendations for future work.

2 The development of WebQual

WebQual is based on 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). Applications of QFD start with capturing the ‘voice of the customer’ - the articulation of quality requirements using words that are meaningful to the customer. These qualities are then fed back to customers and form the basis of an evaluation of the quality of a product or service. In the context of WebQual, web site users are asked to rate target sites against each of a range of qualities using a 5 point scale. The users are also asked to rate each of the qualities for importance (again, using a 5 point scale), which helps gain understanding about which qualities are considered by the user to be most important in any given situation. Although the qualities in WebQual are subjective (and quite rightly so), there is a significant amount of data analysis using quantitative techniques,

for example, to conduct tests of the reliability of the WebQual instrument.

WebQual 1.0 – information quality

The first version of the WebQual instrument (WebQual 1.0) was developed in part from the results of a quality workshop held with students who were asked to consider the qualities of an excellent business school web site (Barnes and Vidgen 2000a). The quality workshop was supplemented with a review of the literature on IS quality (Bailey and Pearson 1983; Ives et al., 1983; Delone and McLean, 1992; Miller, 1996; Strong et al., 1997) and the literature on web site evaluation (Abels et al., 1997; Schubert and Selz, 1997; 2000; Bauer and Scharl, 1999; Dutta and Segev, 2000; Yan and Paradi, 1999). The WebQual instrument was refined through a process of iterative refinement using pilot questionnaires before being released to a larger population. The 24-question instrument was tested by application in the domain of UK business school web sites. Following standard practice in QFD, respondents were asked to rate each business school web site in terms of the 24 qualities and to indicate how important each quality was to them. Analysis of the collected data led to the removal of one question. Based on reliability analysis, the remaining 23 questions were clustered into four major dimensions: ease of use, experience, information, and communication and integration. The WebQual 1.0 instrument, its application and results are more fully discussed elsewhere (Barnes and Vidgen 2000a).

WebQual 2.0 – interaction quality

The qualities identified in WebQual 1.0 formed the starting point for assessing web site information quality in WebQual 2.0. However, in applying WebQual to B2C web sites it became clear that the interaction perspective of quality was largely missing from WebQual 1.0. The work on service quality, notably SERVQUAL (Parasuraman, 1995; Zeithaml et al., 1990; 1993), was

used to augment the information quality aspect of WebQual with interaction quality.

Service quality is commonly defined by how well a service level delivered matches customer expectations (Lewis and Brooms, 1983). Typically, service quality is applied to the delivery of services, for example appliance repair, banking, dentistry and accounting, but SERVQUAL has also been applied to a tyre shop and to discount and department stores (Parasuraman, 1995). There is a service element involved in the delivery of any product, whether it is intangible (such as opening a new credit card account), or tangible (such as buying a book). Although important, in many industries cost is not the sole determinant of competitiveness; the customer experience has come to be recognized as a significant basis for differentiating suppliers. This is particularly the case for suppliers of homogeneous products such as music CDs and books, and one only has to examine examples in the recent media to see how important such ideas are in Internet commerce (Symonds, 1999).

The development of WebQual 2.0 required some significant changes to the WebQual 1.0 instrument (Barnes and Vidgen, 2000b). In order to extend the model for interaction quality, we conducted an analysis of the SERVQUAL instrument in the context of EC web sites and made a detailed comparison of SERVQUAL and WebQual 1.0. This review allowed redundant questions and areas of overlaps to be removed with the result that most of the key questions in SERVQUAL were incorporated in WebQual 2.0, whilst keeping the instrument to 24 questions. The instrument was then tested in the domain of online bookshops, with students being asked to evaluate Amazon, Blackwells, and the Internet Bookshop. A high degree of interactivity was achieved as many of the subjects – students at the University of Bath – were involved in buying books via the Internet (see Barnes and Vidgen (2000b) for a full account).

WebQual 3.0 – an integrated view of web site quality

While WebQual 1.0 was strong on information quality, it was less strong on 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 technical artefact. In reviewing the instruments we found that all of the qualities could be categorized into three distinct areas (Table 1).

<i>Quality dimension</i>	<i>Indicative content</i>
Web information quality	Accurate, timely, reliable information
Web interaction quality	Good reputation; safe to transact; personal data security; will deliver as promised
Site design quality	Easy to navigate; attractive appearance; projects a sense of competency

Table 1: quality dimensions in WebQual 3.0

To test out the WebQual 3.0 instrument we decided to use the domain online auctions. At the time of writing this was a fast-growing area of Internet development and was witnessing a struggle for dominance in the emerging UK and European markets by key players. Furthermore, this was a domain to which we could get direct access to carry out transactions – buying and selling at auction - in order to have a high degree of interactivity between user and web site.

3 Internet auctions

Traditional auctions typically involve people being physically co-located in time and space. Telephone bidding can be used to overcome geography and potential buyers can leave bids prior to the sale to ameliorate the time constraint. In a traditional auction each lot gets very little time, maybe minutes, but possibly just a few seconds (Turban et al., 2000). Goods have to be moved physically from the seller's to the auctioneer's premises and substantial premiums can be

charged charged. For example, an auction house typically charges the seller 15% of the hammer price and often adds a buyer's premium, usually around 10% of the hammer price. It is therefore not uncommon for the auction house to take a 25% commission on the sale price.

The Internet allows auctions to be held at greatly lower cost and can involve many more buyers than traditional auctions. It also allows individual consumers and businesses to participate in Internet auctions. Although C2C auctions are popular currently, B2C and B2B are areas with great potential for growth. The downside of online auctions is that goods cannot be seen physically and the possibility of fraud needs to be addressed through synchronizing the transfer of goods or providing a bonded service. Most sites currently address the fraud issue through long and detailed trading rules and limited guarantees. Despite these issues, Turban et al. (2000) estimate that the Internet auction industry will reach \$52 billion sales by 2002 and OpenSite (1999) report a prediction by Keenan Vision that dynamic pricing transactions will account for 30% of the overall e-commerce total with a volume of \$120 billion in 2002.

B2B auctions offer many opportunities. They represent a new sales channel supporting existing online sales and a new way of disposing of excess, obsolete, and returned product. Managed interactive bidding is one way in which dynamic pricing can be introduced to the procurement process. FreeMarkets OnLine Inc qualifies potential suppliers from around the world and then runs an online bidding process for contracts to supply materials (Jahnke, 1998). Average savings of around 15% for the purchaser are claimed for this process (Fickel, 1999).

Although the primary aim of this paper is evaluate the usefulness and reliability of WebQual 3.0 as an instrument for assessing web site quality, we do so in a specific domain. We decided to use online auctions for the following reasons. Firstly, it is possible to achieve a high degree of interactivity since the subjects can have direct access to C2C auction sites and can

offer and bid for items. Secondly, auction sites are undergoing considerable growth and fierce competition for market share, which means we may be able to use WebQual to make predictions about how the competitors might fare.

4 Research design

The auction experiment was conducted as part of a Masters degree in Management and Information Systems. The subjects were 39 students taking the elective module in Emerging Technologies, which has a large Internet and e-business component. The experiment was design such that it was as natural as possible. It is often argued – with good reason – that using students as subjects is artificial. To make the experiment as realistic as possible the design gave the students a real stake in the outcome and enabled them to gain real experience of browsing, bidding, buying, and selling at an online auction.

Quality workshop

The first stage was to conduct a quality workshop with the class. The workshop started with the subjects working individually in response to the question: “What are the qualities of an excellent auction web site?” The subjects were asked to write the qualities onto post-it notes and to also consider the roles of buyer and seller when thinking about online auctions. Once the subjects had made a list of qualities individually they were put into groups of 5 or 6 and asked to combine their qualities into a single list. The groups were pre-allocated on a random basis by the course leaders. The groups were then asked to structure the qualities into a hierarchy, adding category headings as appropriate. Finally, a representative from each of the groups worked together to combine the qualities into a single structure. The raw qualities (customer verbatims) were collected by the course leaders for analysis. The qualities identified by the subjects were taken

into account when generating WebQual 3.0. We checked for new qualities that were not catered for in the generic instrument and used the domain-specific qualities to create an auction section of the WebQual instrument.

The auction sites and the auction process

For practical purposes the number of sites to be evaluated was limited to three. Given that there were 3 sites, 27 qualities, and importance weightings, each subject is required to make 108 assessments. Our experience is that any more than 3 sites makes the task too onerous, while reducing the number of sites to 2 or reducing the number of qualities also impoverishes the data collection. Similar difficulties have been noted with the SERVQUAL instrument (Parasuraman, 1985). The three online auction companies selected were:

- eBay. A well-known US-based site that has recently started operations in the UK. eBay has more than 2 million items in 1500 categories and one of the highest traffic volumes on the web. The site is number one for stickiness according to the Nielsen Top 25 Internet sites (average visitor time is 1:20:35). eBay is a US-based company that in the first half of 2000 was planning for aggressive expansion into the European market.
- Amazon. This company has the benefit of a strong brand for online book sales and has recently moved into the auction sector. Amazon also has the Z-Shop where goods can be offered for a specified price (an online classified advertising system). Amazon is number six for stickiness according to the Nielsen Top 25 Internet sites with an average visitor time of 15:23.
- QXL is a UK-based auction site that is competing directly with eBay for the European market. QXL's policy is to expand by acquisition, acquiring Ricardo.de, a German online

auction company and a Scandinavian competitor, Bidlet AB (Teather, 2000).

In selecting the auction companies we went for market leaders that are in direct competition. All three are competing for the online auction market in Europe. QXL and eBay are dedicated to the auction sector while Amazon comes in with a strong brand image from which to extend their book sale operations. The quality of their web sites – in terms of site design, interaction, and information quality – could play a significant role in their success in the gaining market share of the online auction business.

All three auctions work in the same way. Buyers and sellers must register before offering lots or placing bids. Sellers must give their credit card details before being allowed to post items. This is because the auction site owner will deduct a commission automatically from the seller when the auction closes. Each of the sites has extensive terms and conditions detailing the rules and charges. These run to 30 or more pages and it is therefore unlikely that all users will print them off and read them carefully. All three sites attempt to convey the message that their site is secure and that they have protection against rogue sellers and buyers.

The auction intervention

Each of the seven groups was given three books to offer for sale, one to be placed on each of the sites. The books were of three types: modern hardback fiction, information systems teaching texts, and technical handbooks (e.g., a guide to HTML). The aim was that the groups would get experience of placing lots on the sites and have the opportunity to bid for each of the other group's books, thus enhancing the interaction experience. To give further experience of bidding at auction the course leaders placed a copy of the course text (Turban 2000) on each of the auction sites and encourages all students to browse for the item and if interested to make an

offer. This introduced an element of competition to the exercise – it would be possible to buy the course text, which was retailing on Amazon at around £30, for as little as £1. The closing dates for bids were between 7 and 10 days. After the auctions had closed the subjects completed the WebQual questionnaire to record their perceptions of the quality of the sites and the auction experience.

The WebQual questionnaire was made available on the Internet. There is an opening instruction page that opens a separate Web browser window containing the qualities to be assessed (Figure 1). The control panel allowed the user to switch the contents of the target window between the different web sites to be evaluated and also to view the instructions and the quality dictionary, which provides a short description for each of the qualities.

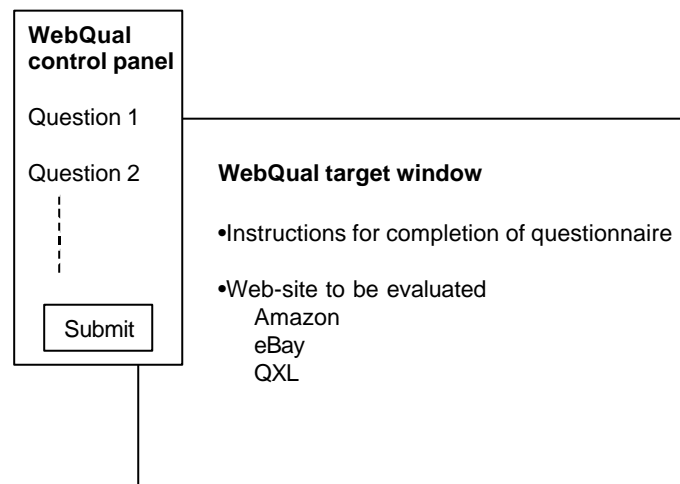


Figure 1: Internet-based WebQual questionnaire (<http://www.webqual.co.uk>)

This design allows the user to decide on the sequence of site evaluation and the order in which the questions are to be answered. For example, the user could decide to answer all of the questions for one site and then move on to the next site, or answer the same question for all three sites, or adopt a mixture of the two approaches. All of the students taking the course completed

the questionnaire, a total of 39 responses.

The groups sold a small number of books for prices between 31 and £5. The course leaders did better, getting up to £26 for the course texts (including a bid from a US-based bidder with an unlikely email address that could not be contacted to complete the sale). There was a high level of interaction with the auction sites with more than half the students being engaged in buying or selling transactions and the rest either making unsuccessful bids or ‘lurking’. The auction intervention resulted in an email bombardment as regular (and lengthy) updates on bidding status were generated by all three sites.

5 Data analysis

The data collected are summarised in Tables 2 and 3. Note that at this stage we have not presented any groupings of the questions to provide pertinent categories (this is discussed below). In all, we received 39 completed questionnaires from students and these formed the basis of the analysis discussed here. Questionnaire responses were received via e-mail, filtered to check for duplicates, and converted into a form usable in SPSS (a statistical software package).

The importance of web site interaction

One important driver in the use of auction site data was to gain some indication of e-commerce qualities based on actual consumer-to-consumer interaction. Intuitively, one would surmise that the full extent of that assessment could only be realistically made when the user tests the full capabilities of a site during activities such as registration, bidding, purchase and sale of items (e.g. in this research new and used books were the focus of attention). Thus, to produce worthwhile results, users were strongly involved in such tasks and experienced a high degree of interaction with the sites over a period of time, typically 7-10 days.

No.	Description	Importance		Amazon		eBay		QXL	
		Avg.	St. Dev.	Avg.	St. Dev.	Avg.	St. Dev.	Avg.	St. Dev.
1	The site is easy to find	4.05	1.05	4.44	0.97	4.15	1.09	3.54	1.19
2	The site is easy to navigate	4.46	0.91	4.10	0.94	3.87	1.13	2.90	1.17
3	The site has an attractive appearance	3.56	0.91	3.82	0.88	3.59	1.02	3.23	1.25
4	The site has a design appropriate to the type of site	3.33	0.93	3.79	0.80	3.54	1.10	3.26	0.97
5	The site generates a sense of competency	3.85	1.04	4.05	0.83	3.77	1.09	3.26	1.16
6	The site creates a memorable experience	3.36	0.96	3.51	0.97	3.41	1.09	2.82	1.21
7	Provides accurate information	4.44	0.85	4.28	0.69	3.90	0.91	3.51	1.12
8	Provides believable information	4.13	0.98	4.13	0.80	3.72	1.07	3.44	1.05
9	Provides timely information	3.87	0.89	4.15	0.84	3.92	1.05	3.44	1.17
10	Provides relevant information	4.08	0.87	4.10	1.07	3.79	1.15	3.49	1.17
11	Provides easy to understand information	4.21	0.98	4.23	0.93	3.85	1.01	3.36	1.35
12	Provides information at the right level of detail	3.82	0.91	3.95	0.94	3.67	1.08	3.28	1.15
13	Presents the information in an appropriate format	3.82	0.88	3.90	0.88	3.82	1.07	3.26	1.16
14	Has a good reputation	4.28	0.94	4.54	0.79	4.08	1.04	3.23	1.11
15	Feels safe to complete transactions	4.74	0.72	4.03	1.25	3.74	1.12	2.90	1.23
16	Personal information feels secure	4.59	0.97	3.87	1.30	3.69	1.17	3.05	1.32
17	Creates a sense of personalization	3.41	1.09	3.90	1.19	3.56	1.12	2.92	1.33
18	Builds a sense of community	3.23	0.99	3.51	1.17	3.28	1.26	2.72	1.26
19	Promotes good communications	3.72	0.89	3.79	0.95	3.54	1.10	2.92	1.16
20	Can be depended upon to deliver goods/services promised	4.51	0.82	4.13	0.98	3.64	0.93	3.13	0.95
21	Reaches the right target buyers	3.62	0.99	3.85	0.81	3.56	0.91	3.10	0.82
22	Generates good prices for the seller	3.92	0.96	3.36	0.90	3.36	0.99	2.87	1.08
23	Sells products quickly	3.77	0.90	3.46	0.94	3.38	0.99	2.82	1.10
24	Has trustworthy buyers	4.00	0.89	3.67	0.84	3.31	0.92	3.10	0.85
25	Has appropriate choice of products	3.87	0.89	4.03	0.81	4.08	0.98	3.62	1.07
26	A good place to find bargains	3.95	0.76	3.64	0.87	3.95	0.89	3.56	0.97
27	Has trustworthy sellers	4.23	0.93	3.74	0.85	3.67	0.90	3.23	0.74

Table 2: Average and standard deviation information for the questionnaire

All users registered, bid for items and placed items for sale. In addition, fortunately, a large number of respondents actually purchased or sold items alongside questionnaire completion, indicating a strong grounding of the data in actual e-commerce transactions. In all, 21 individuals bought or sold books (representing 54% of the sample). Some individuals purchased or sold items via several sites, so that a total of 39 transactions were made. The breakdown of this interaction was skewed towards the well-known US-originated players Amazon (18 transactions) and eBay (14 transactions), with the UK-originated player QXL some way behind (7 transactions in total). As we shall see below, part of the bias in the volume of transactions is explained by the users' reactions to sites (both quantitative and qualitative), where QXL fared much less favourably than the other auction houses.

Furthermore, in order to verify that the responses to questions are not biased according to purchase/sale or non-purchase/non-sale of items, a number of statistical tests were conducted on

the weighted data. Specifically, the response data for each of the three web sites was divided according to the binary variables of book purchase and sale, and each set was analysed using Levene's test for equality of variances and a t-test for differences in means. The results suggested that, with a few notable exceptions, the means were comparable for groups for all the data sets, with 95% confidence. The exceptions were some close calls for a few questions in separate data sets, strongly influenced by the low sample of purchases. In the overall context of the complete sets of data, these differences were not considered important. Similarly, and also with a few notable exceptions, Levene's test confirmed the sample variances were comparable for the purchase/sale and non-purchase/non-sale groups of the web sites, again with 95% confidence. As above for the t-tests, there were some close calls on single data sets; again these appeared to be due to the low responses for sale or purchase, which hindered the analysis.

No.	Description	Max. Score	Amazon		eBay		QXL	
			Wgt. Score	WQI	Wgt. Score	WQI	Wgt. Score	WQI
S1	The site is easy to find	20.26	18.23	0.90	16.97	0.84	14.38	0.71
S2	The site is easy to navigate	22.31	18.72	0.84	17.51	0.79	13.03	0.58
S3	The site has an attractive appearance	17.82	13.77	0.77	12.95	0.73	11.90	0.67
S4	The site has a design appropriate to the type of site	16.67	12.67	0.76	11.85	0.71	10.92	0.66
S5	The site generates a sense of competency	19.23	16.05	0.83	14.87	0.77	12.90	0.67
S6	The site creates a memorable experience	16.79	12.10	0.72	11.64	0.69	9.79	0.58
F7	Provides accurate information	22.18	19.15	0.86	17.62	0.79	15.92	0.72
F8	Provides believable information	20.64	17.49	0.85	15.82	0.77	14.56	0.71
F9	Provides timely information	19.36	16.54	0.85	15.23	0.79	13.92	0.72
F10	Provides relevant information	20.38	17.23	0.85	16.03	0.79	14.72	0.72
F11	Provides easy to understand information	21.03	18.41	0.88	16.79	0.80	14.62	0.70
F12	Provides information at the right level of detail	19.10	15.41	0.81	14.36	0.75	12.87	0.67
F13	Presents the information in an appropriate format	19.10	15.13	0.79	14.72	0.77	12.82	0.67
T14	Has a good reputation	21.41	19.90	0.93	17.82	0.83	14.10	0.66
T15	Feels safe to complete transactions	23.72	19.51	0.82	17.92	0.76	13.79	0.58
T16	Personal information feels secure	22.95	18.33	0.80	17.26	0.75	14.18	0.62
T17	Creates a sense of personalization	17.05	14.08	0.83	12.72	0.75	10.23	0.60
T18	Builds a sense of community	16.15	11.85	0.73	11.31	0.70	9.23	0.57
T19	Promotes good communications	18.59	14.59	0.78	13.62	0.73	11.18	0.60
T20	Can be depended upon to deliver goods/services promised	22.56	19.13	0.85	16.77	0.74	14.28	0.63
A21	Reaches the right target buyers	18.08	14.13	0.78	13.21	0.73	11.46	0.63
A22	Generates good prices for the seller	19.62	13.26	0.68	13.33	0.68	11.21	0.57
A23	Sells products quickly	18.85	13.38	0.71	12.97	0.69	10.77	0.57
A24	Has trustworthy buyers	20.00	14.92	0.75	13.31	0.67	12.56	0.63
A25	Has appropriate choice of products	19.36	15.87	0.82	16.15	0.83	14.28	0.74
A26	A good place to find bargains	19.74	14.56	0.74	15.79	0.80	14.10	0.71
A27	Has trustworthy sellers	21.15	16.23	0.77	15.74	0.74	13.92	0.66
TOTALS:		534.10	430.64	0.81	404.28	0.76	347.67	0.65

Table 3: Weighted scores and the WebQual Index (WQI)

Discussion of the summary data

The data summary provided in Table 2 shows a number of items for discussion. The columns represent four data subsets based on the 39 responses: the importance rating for each question and the per question ratings for each of the three online auction houses (each of which was based on a scale of 1 to 5). Two summary items are shown in the table for each question and subset: the mean and standard deviation.

Referring to Table 2, we see some interesting patterns in the data. Overall, the average importance rankings are quite high, ranging from 3.23 to 4.74, strongly tending towards the top of the possible 1 to 5 scale. Intuitively, this may indicate some face validity in the qualities being assessed. Looking deeper, in terms of the importance ratings of particular questions, there are some useful groupings to note. Those questions considered most important, e.g. above upper quartile of 4.22, are mostly about trust, including issues of security, delivery and reputation. Accurate information (again a possible trust issue) and easy navigation also feature as important aspects for auction site users. Here we find, in descending order of importance, questions 15, 16, 20, 2, 7, 14 and 27. At the other end of the spectrum, those questions considered least important, e.g. below the 3.74 lower quartile, are based predominantly around the “look and feel” of a site, e.g. design, aesthetics, site experiences, community and personalization. Specifically, questions 20, 5, 19, 7, 22 and 23 are in ascending order of importance. Other questions are in between, and the median is 3.92.

The results suggest that there are a number of priorities demanded from auction sites by web users. In particular, customers are most concerned with finding accurate information, and being able to securely and reliably order 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 design features, which appears to be a general trend (Dutta and Segev, 2000). Interestingly though, some of the popular ideas of personalisation and community rank low in the ratings (Kannan et al., 2000; Schubert and Selz, 2000). This is likely to be due, in part, to slow adoption and acceptance of some of these ideas in this commercial domain.

There are some differences in the standard deviations of ratings for particular questions and sites, although overall, the patterns are similar. For example, the respondents appeared more certain about products offered (questions 26 and 26), the types of users (questions 21, 24 and 27) and information accuracy (question 7), than about the security of transactions or personal information (questions 15 and 16), site empathy (question 17 and 18), and some aspects of information adequacy (questions 10 and 11).

Turning to the results for the ratings of individual sites, we find some very stark contrasts. The unweighted averages in Table 2 show very clearly that the Amazon UK site is a clear leader in its rankings. The site scored consistently higher than the other two sites for all but three items – questions 22, 25 and 26. Of the other two sites, eBay is a very clear second, whilst QXL is a definite last place for all question rankings.

WebQual indices

The weighted results shown in Table 3 serve to accentuate the differences indicated above in the direction of user priorities. Again, Amazon appears to rank highest, although there is more competition in the rankings between Amazon and eBay. The total weighted scores give some indication of this.

Unfortunately, the weighted scores make it difficult to give a benchmark for the sites. One way to achieve this is to index the total weighted score for sites against the total possible

score (i.e. the total importance multiplied by 5, the maximum rating for a site). To this end, Table 3 shows the maximum scores for each question and site. It also shows the WebQual Index (WQI) for each question and a summary WQI for each site (indicated in bold italics). Taken as a whole, Amazon is benchmarked head and shoulders above the other auction sites, with an overall WQI of 0.81. eBay follows with a WQI of 0.76, whilst QXL is a long way behind at 0.65.

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, reliable sub-groupings. To this end, the next section derives a set of subcategories and applies them to the analysis.

Scale reliability and question subcategories

In order to give some indication of the scale reliability of WebQual 3.0, a statistical reliability analysis was conducted using Cronbach's α . The test was conducted on the empirical data from each of the online auction sites. The resultant values of α averaged at 0.96, suggesting that the scale is quite reliable.

Furthermore, to better facilitate comparison between the web sites, reliability analysis was extended to a number of question sub-groupings. In this sense, the generation of subcategories is relatively similar to the work associated with SERVQUAL (Zeithaml et al., 1990). As a starting point, notice that within Table 3 qualities in the WebQual 3.0 questionnaire are provided along with a code tag. This code is used as part of the analysis to break the qualities into four pertinent sets - each with 6 or 7 items. The qualities are explained as follows:

- “S” refers to *Site*-related qualities, the tangible and less tangible aspects of the site experience, e.g. appearance, navigation and experiences.

- “F” denotes the quality of *inFormation*, the suitability of the information for the user’s purposes, e.g. accuracy, format and relevancy.
- “T” implies *inTeraction* qualities, the relationships built as the user delves deeper into the site, e.g. secure transactions, personalization and communication.
- “A” relates to domain-specific qualities, i.e. those referring explicitly to *Auction* web sites. This is both from buyer and seller perspectives, e.g. good prices for the seller and bargains for the buyer.

The first three categories are generic (and informed by considerable previous research) whilst the last is domain-specific. As WebQual develops further, we see such a modular approach to instrument design as a very pragmatic stance; in each application of the tool in a given domain there may be both general qualities (such as “S”, “F” and “T”) and those which are context-specific (like “A” in this instance).

Category	Qualities	Average α
Site quality	Q. 1-6	0.85
- site navigation	Q 1-2	
- site look and feel	Q. 3-6	
Information quality	Q. 7-13	0.91
- information	Q. 7-13	
Interaction quality	Q. 14-20	0.88
- trustworthiness	Q14-16, 20	
- customer relationship	Q17-19	
Auction quality	Q. 21-27	0.83
- selling	Q 21-24	
- buying	Q25-27	

Table 4: Summary of reliability analysis for questionnaire categories

Importantly, the four categories show a strong degree of statistical reliability, as shown in Table 4. The average values of Cronbach's α are quite high for the categories, with all exceeding 0.8.

Thus, it appears that we have a reliable set of question groupings. This provides a more solid foundation for assessment, based on a stronger recognition of the association between certain questions.

Within the core categories, we initially identified some possible subcategories for questions.

These are also shown in Table 4 and can be explained as follows:

- *Site navigation*. The ease of finding a site and getting around a site to find specific items.
- *Site "look and feel"*. Appearance of the web site and the subsequent impact of the design on the user.
- *Information quality*. The appropriateness of information for the task(s) at hand.
- *Trustworthiness*. Credibility and freedom from risk or doubt in exchanging personal information or transacting with the site to buy or sell goods.
- *Customer relationship*. The quality of the relationship built with the customer via interaction. This includes some empathy with the customer to provide the right environment for interaction - including customisation, community and communications.
- *Selling quality*. The quality of the auction site from the perspective of the seller, especially in terms of buyers and auction dynamics.
- *Buying quality*. The quality of the auction site from the perspective of the buyer, especially in terms of products and sellers.

As we shall see in the next section, these provide some useful extra insight into the core categories.

Site analysis using question subcategories

By utilising 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 is easily compared to its rivals. Thus, we are

in a better position to examine why some sites fared better than others on the WebQual index.

Figure 2 gives an example of how this can be achieved.

As a starting point, the data was summarised around the ten 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 5). Figure 2 is the result, which rates the three web sites using these criteria. Note that the scale has been restricted to values between 0.5 and 0.9 to allow for clearer comparison.

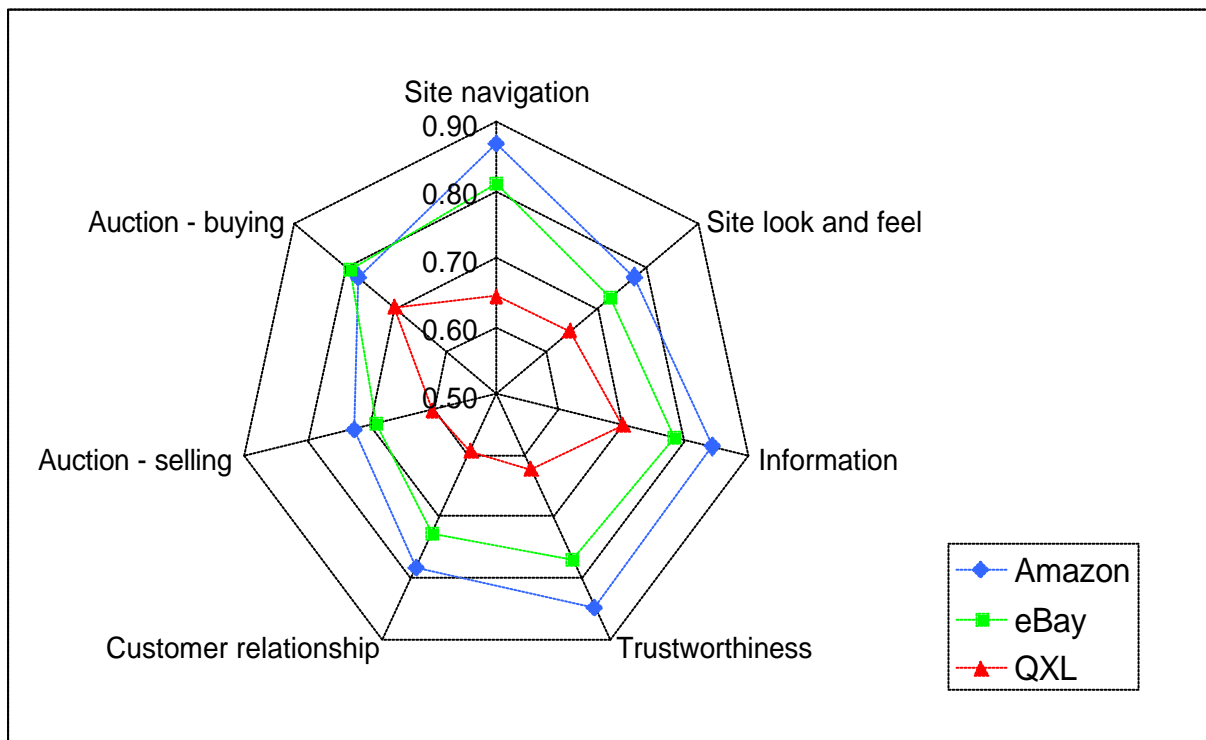


Figure 2: Radar chart of WebQual 3.0 subcategories for the three web sites

Figure 2 demonstrates very clearly that the Amazon UK site stands well over the two rivals in terms of the qualities assessed. The indices for the subcategories for Amazon make a clear boundary around the other two sites, enveloping all competitors' categories except one. In

absolute terms, Amazon rates strongly for site navigation and information quality. Not surprisingly, Amazon also fares particularly well in terms of its trustworthiness; it is, after all, a very well known and established player in online trade, e.g. as a cyber-bookshop. Other areas are less strong, in relative terms, although still around 5 percentage points better than the nearest rival, eBay. However, eBay edges slightly ahead of Amazon for auction buying quality; apparently, this established US-originated auction house is able to provide a good range of products at competitive prices.

Of the two other sites, eBay appears to be much stronger, with a consistent set of rankings well above QXL on the radar chart. Overall, the indices are around the 0.69 to 0.81 mark, scoring particularly well (in absolute terms) for site navigation, information quality, trustworthiness and auction buying categories. The general shape of these scores is quite similar to that of Amazon. All of the categories for eBay are clearly in excess of the lagging player, QXL.

The UK-originated player QXL has some very varied indices that create an oval shape in the centre of the radar chart. However, interestingly, QXL performs less well on some categories than others. For example, trustworthiness, site navigation and customer relationship appear to rate particularly badly, and this tallies with some of the qualitative analysis below; users found it difficult to get around the site to find products and were frustrated by the cumbersome registration process and perceived lack of security.

The validity of WebQual 3.0

It is worth mentioning some points regarding the validity of the WebQual instrument. In developing the tool, we have paid attention to creating a scale that has some validity in measuring perceived quality of e-commerce web sites. In terms of content, we believe that the

questionnaire is relatively balanced, drawing on an analysis and integration of items relating to web site information quality (Bailey and Pearson, 1983; Barnes and Vidgen, 2000a; Strong et al., 1997), service quality (Zeithaml et al., 1990; 1993), interaction quality (Barnes and Vidgen, 2000b; Dutta and Segev, 2000) and site design considerations (Barnes and Vidgen, 2000a; Schubert and Selz, 2000). Thus, in terms of the dependency on theoretical considerations, this adds a high degree of validity.

From the results of the research, the instrument does appear to have some usefulness in analysing the chosen web sites. Insofar as some aspects of auction site quality are observable, it appears to provide a reasonably valid indicator of criteria. The additional qualitative data and discussion further underlines the validity of the instrument and adds a degree of synergy. Evidence from other studies of cyber-auctions also tends to be supportive (Klein, 1997; Prince, 1999; Turban, 1997).

The questionnaire has purposefully been kept to a manageable size for data collection. This stance is in line with similar work on instruments for measuring service quality (Zeithaml et al., 1990). However, whilst we believe that it captures many of the important generic items that have been uncovered by our research in four domains, of course it does not cover all possible items. Further relevant and domain-specific items may emerge as we further refine and test the instrument in different areas of e-commerce (e.g. in the domain of on-line newspapers). This will help to extend the external validity of WebQual 3.0.

6 Discussion

The quantitative analysis shows clearly that Amazon comes out on top in terms of user-perceived quality. While eBay is a close second, the QXL site fared less well by a significant margin. The strength of Amazon may be in part due to brand image. One of the respondents commented:

“I really did not like the QXL website, it takes an hour to register, the icons are so small I practically needed a magnifier to see them, not a good experience.... I loved Amazon though!!!! But then again, I might be biased towards it because of its reputation. I guess advertising and the name are very important.”

Many of the subjects were already registered with Amazon for book purchases. This made it easier to access the Amazon auctions since the user ID is transferable across the different sections of the Amazon site. Respondents were concerned about giving out their credit card details to the auction sites, which may have worked in Amazon’s favour; once credit card details have been already divulged for book purchases, it is but a small step to explore and use the auction and Z-Shop sections of the Amazon site. Existing Amazon customers also avoid the lengthy registration process involved if they want to use a different auction site. Thus, for existing Amazon users there are significant switching costs and a perception of new risk in using other auction sites. QXL rated low on the perceptions of security (see the “Trustworthiness” rating in Figure 2) and this could be a major issue given that the auction sites are automatically charging amounts to the seller’s credit card when items are sold.

The following comments made by respondents in the questionnaire demonstrate the strength of feeling against the QXL site:

“It was very difficult to register on QXL. It also didn’t feel secure. Difficult to navigate on the site and find items you search. Easier to navigate on Amazon and eBay.”

“Amazon easy to use, pleasing on the eye. QXL slightly too busy to look at.”

“Found QXL very frustrating to place a book on.”

“I had a bad experience with QXL. The registration was too slow and I experienced some problems with my registration. I had to email customer support a few times to get my registration completed.”

“QXL was hopeless. It took long, and you had to input your Visa card number. I did not feel safe at QXL.”

“Finding our own items can take minutes rather than seconds, QXL the worst, even with the reference number!”

There was also concern about the auction process and the buyer/seller interaction and concerns

about whether the buyer will indeed buy and the seller will dispatch the goods once payment has been received:

“A hassle not to be able to communicate directly with buyer. Should have a chat facility to allow details to be sorted between buyer and seller.”

“I didn't agree with the unstructured mechanism with which goods are required to be delivered between the two parties. I would maybe prefer using a system where delivery is organised by the auction site, or there is some mediation with the site.”

“Later, I 'sold' a book but when I contacted the buyer, there was no reply from that person.”

The comments show clearly that a successful auction site must above all else feel secure to the user. Secondly, a successful auction site needs to manage the buyer/seller interaction carefully, taking full account of the differences between traditional (same time, same place) and online auctions. Bad experiences with payment and delivery of goods will deter customers from using online auctions and the auction site owners need to manage this process very carefully. Based on our WebQual results and the comments of our respondents we would be concerned about eBay's ability to compete with the Amazon brand image and its ability to catch up with Amazon's European customer base. We wonder whether QXL will be able to compete effectively with either Amazon or eBay and would question its strategy of growth by acquisition.

7 Conclusions

WebQual 3.0 is based on three dimensions of customer-perceived quality: information quality, interaction quality, and site design quality. The instrument has been tested in the domain of online auctions and the results show that it has a significant level of reliability. Further applications of WebQual are needed using larger samples and subjects drawn from different customer segments. We also plan to test the instrument in the B2B sector, which is predicted to be significantly larger and faster growing than the B2C or C2C sectors.

In terms of the auction domain, the results show that Amazon has a clear lead over eBay and QXL and that QXL is lagging significantly behind the other 2 sites. A low WebQual index may indeed signal the need to carry out a site redesign, but it also reflects in part the standing of the organization in the marketplace with respect to its competitors. In its current form WebQual provides a valuable diagnosis of where potential problems may lie, but it does not provide a prognosis. We are, therefore, extending WebQual by identifying objective web site characteristics that will help organizations to improve information quality, interaction quality, and site design quality.

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