

## DESIGNING FOR WEB SITE USABILITY

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### ABSTRACT

This paper explores the customer perspective of World Wide Web (WWW) site design in the light of current WWW usability research. A usability study undertaken by Spool et al. (1999) is replicated where testers search for specific information on a WWW site and answer a usability questionnaire. The search was carried out on New Zealand winery WWW sites. The results are compared to the findings of Spool in the areas of navigation, graphics and page layout. All three areas are found to be significant influences on WWW usability. Additional recommendations concerning guidelines for usability are made.

### Keywords

Web usability; User expectations; User interface; Interface design

### INTRODUCTION

A substantial body of business World Wide Web (WWW) research investigates the business perspective relating to the purpose of WWW pages (Banks 1999, Lowry et al. 1999, Hasan & Tibbit 1999, Lee et al. 1999, Ridley & Ridley 1999, Spadaccini & Burn 1999) and WWW page implementation problems (Hasan & Tibbit 1999, Lane & Cavaye 1999, Lowry et al. 1999, Ridley & Ridley 1999, Van Akkeren & Cavaye 1999). Few researchers have approached business WWW sites from the perspective of the customer in Australia and New Zealand. Ng et al. (1998) have found that the most frequent response to a question on future development of company WWW sites was 'more interaction with users'. Such customer interaction can only be assured through research into their perceptions of current WWW sites. Features of customer interfaces, such as navigation, that make it easier for customers to find information, positively influence the number of visitors to a site (Lohse & Spiller 1999). The aim of this research was to evaluate regional small business web sites from a customer usability perspective using the approach documented by Spool et al. (1999). This paper presents a review of the relevant literature in the field of WWW usability design. This is followed by a description of a study of New Zealand winery WWW sites that was undertaken. The paper concludes with key findings of the study concerning WWW usability design considerations and recommendations for future work.

### LITERATURE

The objective of the literature search was firstly to define WWW usability, then to identify appropriate usability measures. Significant work in this area has been conducted by Nielsen (2000) and Spool et al. (1999). One limitation of current usability studies is an understanding of the level of WWW experience testers brought with them to the study and the final part of this section presents relevant literature on factors that influence WWW experience.

#### WWW usability defined

There is no common definition for the term usability (Corry et al. 1997). We use Keevil's (1998) definition of WWW usability as 'a measure of how easy it is to find, understand and use the information displayed on a web site'. In addition, we add that Web site usability is also about 'identifying the obstacles to users accomplishing their goals' (Spool et al. 1999). Usability studies do not necessarily attempt to measure the extent to which the developers have achieved their design objectives. In the usability testing described within this paper the researchers did not have information about the objectives of the developers of the web sites in question. Thus this study is distinct from web site rankings and top ten lists since we do not set out to say which of the tested sites are more or less successful.

Although WWW usability measures originate from the field of software usability, WWW site usability is more important than that of traditional software because the Internet provides users with user controlled navigation in a try before you buy environment (Nielsen 2000). In addition, the WWW pages must invite, attract or pull the user in to engage in further exploration by its look and feel before the user has time to move on to the next link (Singh & Dalal 1999). After the event of initial access, site usability becomes critical.

**Identifying appropriate usability measures**

Four recent instruments designed for customer evaluation of IT can be identified in the literature. The instrument developed by Goodhue (1998) has been designed to measure user evaluation of an Information System. The instruments used by Selz and Schubert (1998) and Srivihok (2000) are designed to measure customer evaluation of web commerce sites. The instrument used by Spool et al. (1999) is designed to measure customer evaluation of web sites in general. Table 1 lists a number of variables, indicating which are used within the respective user evaluation instruments. These variables are discussed below in order to identify appropriate measures of WWW usability.

Variable	User Evaluation Assessment Instrument			
	Goodhue	Selz	Srivihok	Spool
Information	√	x	x	x
Accuracy	√	x	x	√
Compatibility	√	x	x	x
Navigation	√	√	√	√
Speed	√	√	√	√
Interface	x	√	x	x
Help	√	x	√	√
Trust	x	√	x	x
Friendliness	√	x	x	x
Currency	√	x	√	√
Appearance	√	x	√	√ <sup>5</sup>
Personal	x	√	x	√ <sup>6</sup>
Security	x	√	√	x

**Table 1: Factors in user evaluation instruments**

Analysis of the user evaluation instruments revealed that Goodhue (1998) suggests three variables used to measure user evaluation of Information Systems that are not included in the other instruments. These variables are: compatibility, information (meaning the right level of detail) and friendliness (meaning ease of use of hardware and software). These variables are also not used within this study for the following reasons:

- Compatibility relates specifically to browser software and some plug-in software, which are not directly relevant to this study.
- The level of detail on a WWW site is measured by the more specific variables such as navigation.
- Ease of use of hardware and software was not considered a relevant factor: the study was conducted on a reliable network with experienced users. None of the users subsequently commented on this issue.

There are three variables used by Selz and Srivihok which are not considered appropriate in the winery usability study. Firstly, security is not measured since this study did not involve the exchange of any sensitive information. Secondly, the interface is measured in more detail by the usability instrument. Thirdly, Selz measured contact possibilities of ecommerce sites (listed above as trust). The contact possibilities variable has not been used since it is a measure of user trust rather than usability.

The variables used by Spool are not contradicted by any of the other instruments and appear to be the most relevant measures of WWW usability. They are therefore selected as the most suitable instrument for the winery WWW usability study.

**Properties affecting usability**

Nielsen (1998) laments that most WWW sites have never been tested by real users before being published on the Internet. The only test WWW sites get according to Nielsen (1998) is when they are taken to the 'art director's office to look at the screen'.

Nielsen (2000) suggests that care should be taken with the presentation of the content of the WWW site. This includes writing for scanability using structured and meaningful headings, bulleted lists and using highlighting

<sup>5</sup> Includes appearance; graphics relevance; graphics quality; ease of reading; quality of language

<sup>6</sup> Includes fun; distractions and personal productivity

for emphasis. He also suggests using plain language and writing in the inverted pyramid style by placing the most important facts up front. Legibility of the text can be improved by ensuring a high contrast between background text colours, using plain rather than patterned backgrounds, using larger fonts and ensuring text stands still instead of using animation or scrolling banners. Arranging information in 'chunks' of short reference documents intended to be read non-sequentially is a practice used in technical and administrative documents that applies to presenting information on WWW sites (Lynch & Horton 1999).

Spool et al. (1999) conducted a study on the usability of eight well known corporate WWW sites. The data for this study was collected during 1997 using a set of 'scavenger hunt' tests. The participants of the study were observed finding information on the web sites. Their ease of finding information was measured by use of both observation and questionnaires.

As a result of this study Spool presents three findings that he argues contradict accepted WWW design guidelines:

- 1) Web sites that separate content from navigation make it harder to find information.
- 2) Graphics appear to make no difference to usability with the exception of animation, which was very annoying.
- 3) It is not safe to assume that good page layout, as practised in hard copy publication, applies to web design. For example, Spool argues that white-space and page readability on WWW pages makes information harder to find.

Although these three findings form the basis of the book by Spool et al. (1999), the relationship between the findings and the evidence presented is limited. To date there has been some work on WWW usability testing using video tape to record scenario-based testing of sites (Osterbauer et al. 2000).

### **Tester WWW experience**

The study by Spool et al. (1999) does not attempt to gauge the prior level of WWW experience of the testers involved in their study, apart from providing testers with identical experience immediately prior to testing. For the purposes of the winery WWW usability study, prior WWW experience is considered a relevant factor. It can help researchers understand if usability obstacles are a factor of WWW literacy that will disappear when WWW users become more capable. In order to do this a definition of WWW experience was formed from the literature. WWW experience is influenced by a) demographic characteristics of the participants, b) past behaviour and c) access type.

a) Demographic characteristics such as race, gender, age, education level, household income, number of children at home, occupation, geographic region and gender by generation groups are all known demographic variables likely to influence WWW experience (Katz & Aspden 1997, Kraut et al. 1996, Hoffman et al. 1996). This study measured gender, age, education level and number of children.

b) Past behaviour is measured through usage history and the type of activities performed. Usage history can be measured in monthly and daily frequency as well as the overall time since first becoming familiar with the WWW (Hoffman 1996 & Teo et al. 1996). The type of activities undertaken can be described using four categories of usage experience as described by Teo et al (1996). The usage experience categories are: messaging, browsing, downloading and purchasing.

We relied on respondents to report their past WWW behaviour and measured browsing and purchasing usage. Data on messaging and downloading usage was not collected since these two activities relate to the Internet and not specifically to WWW pages.

c) Access type can be described by type of access account, access location and home computer ownership (Teo et al. 1996, Hoffman 1996). We collected data on all three of these variables.

### **METHOD**

The aim of the Wine Web Usability study was to explore WWW usability and to replicate the study by Spool et al. (1999). Firstly, a self-administered questionnaire was designed to collect data on experience in using the WWW, and experience with the subject area of the sites (wine). Questions were developed to gather information on wine purchasing behaviour and interest in trying new wines. Wine purchasing behaviour was measured by purchase frequency, purchase amount and purchase place.

Secondly, testers answered a set of questions about eight winery WWW sites. Following this they completed a questionnaire, which included questions concerning their experience whilst searching the web site and their perceptions of WWW site usability. This questionnaire used the variable suggested by Spool as previously discussed. However, the proportion of answers that were 'correct' have not been measured.

## Sample

The population of WWW testers in the wine WWW usability study were the 93 members of the social club at a tertiary education institution. The social club was chosen because it is made up of people that represent the economic and social characteristics of potential customers of wine WWW sites.

Since WWW sites differ between industries, it was decided to concentrate on one industry in this study rather than risk being unable to compare between industries. Winery WWW sites were chosen because they are generally small regional businesses well represented in New Zealand with a product that is suitable for mail order and sale over the WWW.

## Phase one WWW and wine experience

The purpose of phase one of the wine WWW usability study was to determine the level of WWW and wine experience among the sample population. This was measured by means of a questionnaire. Ninety-three questionnaires were distributed and 73 were returned giving a response rate of 79%. Descriptive statistics were used to analyse the WWW and wine experience variables.

## Phase two testing WWW usability

The purpose of phase two of the wine WWW usability study was to rate the eight winery WWW sites based on usability measures and to record the testers subjective experience of using the WWW site.

Respondents of the WWW and wine experience questionnaire were asked to indicate their willingness to test WWW sites. Of the 73 respondents of phase one, 50 were willing to test WWW sites and 40 testers actually completed the testing. The group of testers was statistically compared to the respondents of phase one and there were no significant demographic, WWW experience or wine experience differences between the groups. Since each person tested three WWW sites, this stage resulted in 120 usable responses. The WWW sites were distributed randomly to control for the order that respondents did the testing.

To test a WWW site, respondents answered four questions by seeking information from the site. The questions were formatted so that the answers were multiple choice, yes / no and short answer to allow the respondent to complete the questions quickly. In formulating the questions the content as suggested by Spool et al. (1999) was used. The content of the four questions was as follows:

1. simple fact question
2. judgement question based on one fact
3. comparison of several facts question
4. judgement question based on several facts

The answers to questions one and three could be found in the information on the web site. The answers to questions two and four required the participant to use the information on the web site to make a judgement. For example, testers were asked 'what variety of grapes are grown at the [B] vineyard?' Although the answers to these winery questions are important, this paper does not deal with the analysis of the answers to these questions. Participants were assured that the exercise was not a test for themselves, but a test for the web site. They were instructed that if they could not find the answer to one of the questions after a genuine search they were to note the question and move on.

After each WWW site test, respondents completed a questionnaire consisting of questions relating to their experience using the site and the usability of the site. Each of the questions used a seven point Lickert scale where one was negative and seven was positive, for example one equals unacceptable and seven equals excellent.

Data from the WWW usability tests was analysed using the mean of the scores for each of the variables shown in the tables below. Spool selected those variables representing the success of the search, then rated the WWW sites on their usability by multiplying these together and converting them into a percentage. In this research we use the total mean score for both the experience and usability questions. This appeared to be just as accurate in indicating the usability of the WWW sites. Analysis of the scores and tester comments are used to analyse the information further.

## FINDINGS

This section describes firstly the results of the WWW and wine experience questionnaire to give a profile of the testers. Then the findings of the user experience and usability tests are presented.

### Phase one: Tester Profile

A profile of the testers was built up through analysis of the demographic, wine experience and WWW experience data collected. The WWW and Wine experience analysis suggests that the testers are a moderately educated, sample of mainly middle-aged men and women. The majority of respondents purchase wine and have a general interest in finding out about wines. There is almost 100% access to the Internet either at home or work amongst the testers and they have a high exposure to the Internet in terms of opportunity and amount of use. The Internet experience questions suggest that our study achieved a good representation of confident and non-confident WWW navigators. The testers are mainly search dominant customers with some WWW browsing interest. About half of the testers are likely to use the WWW for business. The testers were not accustomed to purchasing wine on the Internet and few were likely to have researched wine on the Internet before making a purchase from the store.

### Phase two: Usability Responses

To protect the confidentiality of the wineries, each of the wineries were assigned a letter of the alphabet from A to H. A mean score for the experience questions and the usability questions was calculated and these are displayed in table 2 and table 3 respectively. The site rankings were determined using the total of the mean scores.

Item	Wine WWW Sites							
	B	A	H	E	F	D	G	C
1. Physical feeling right now	3.46	4.31	3.87	4.41	4.89	4.53	4.88	4.77
2. Mental feeling right now	2.31	4.31	4.27	4.53	4.83	5.53	5.50	5.54
3. Frustrated / always knew what to do	2.23	4.38	4.40	4.71	4.89	5.07	5.31	5.31
4. Faster / slower than expected	3.00	3.77	3.93	4.06	4.33	4.80	5.13	4.92
5. Quality of information	1.77	4.38	4.40	4.94	5.53	5.93	5.50	6.08
6. Confident your found all the information	2.08	3.08	4.33	5.41	5.56	5.73	5.62	5.85
7. Feeling now task is over	2.08	3.77	4.33	4.24	4.11	4.80	4.50	5.31
Total	16.93	28.00	29.53	32.30	34.14	36.39	36.44	37.78

**Table 2: Experience mean scores for each WWW site arranged in ascending site rankings**

The data shows that testers did not have a good experience using web site B. Generally testers rated the quality of information as very poor (1.77), a very low score on a seven point Lickert scale. In contrast the mean score for quality of information for site C was very high (6.08). Similarly there is a very big range of results for users confidence in finding all the information (2.08 – 5.85).

Item	Winery WWW Sites							
	B	A	H	E	F	D	G	C
1. Ease of finding specific information	1.77	3.85	4.36	5.00	5.06	5.13	5.53	5.46
2. Ease of reading data	3.83	4.92	5.00	5.24	4.82	5.73	5.53	5.46
3. Ease of concentrating on the data search (distractions)	3.15	4.92	4.79	5.53	5.06	5.47	5.60	5.85
4. Logic of navigation	2.85	4.31	4.79	4.82	5.00	5.00	5.80	5.92
5. Ease of search	3.23	4.08	4.50	4.71	4.94	4.80	5.27	5.62
6. Appearance of site	3.33	5.38	4.50	4.94	5.35	5.93	5.53	5.77
7. Quality of graphics	4.54	5.62	5.36	5.19	5.47	6.07	5.60	6.08
8. Relevance of graphics	4.23	5.54	4.21	5.35	5.71	5.73	5.93	5.85
9. Speed of data display	4.23	6.00	5.71	5.53	5.47	5.87	5.93	6.23
10. Timeliness of data (is it current?)	2.67	4.62	5.36	5.47	5.18	5.47	5.40	5.50
11. Quality of language	3.08	5.31	5.29	5.71	5.35	5.73	5.47	5.85
12. Fun to use?	2.69	4.46	3.93	4.94	4.24	4.80	4.73	4.77
13. Explanations of how to use site	2.23	3.92	3.79	4.00	4.18	4.00	4.80	4.46
14. Overall ease of use	3.00	4.38	4.21	4.53	5.00	5.00	5.60	5.54
15. Completeness with which the site's subject is treated	1.54	4.25	4.71	5.29	5.29	5.57	5.93	5.62
16. Your overall productivity with the site	1.54	4.23	4.69	5.12	5.27	5.50	5.71	5.50
<b>Total</b>	<b>47.91</b>	<b>75.79</b>	<b>75.20</b>	<b>81.37</b>	<b>81.39</b>	<b>85.80</b>	<b>88.36</b>	<b>89.48</b>

**Table 3: Usability mean scores for each WWW site arranged in ascending site rankings**

Each item from table 3 is a measure of usability and a potential obstacle to finding information on the WWW site. For example, insufficient 'explanations of how to use the site' present an obstacle to the user searching for information.

The data shows that testers regarded web site B as being very 'incomplete' (1.54) and 'difficult to find specific information' (1.77). In contrast, site C was regarded as 'complete' (5.62) and 'easy to find subject information' (5.46). High ranking WWW sites rated well for all the variables and similarly, low ranking WWW sites rated poorly for all variables. This suggests that usability is an overall package rather than having some factors that can be done well and some that can be done poorly.

## DISCUSSION

This section compares the results of the winery usability study with that of the corporate usability study undertaken by Spool et al. (1999). Then new issues raised by this research are discussed. Finally, some general observations are made concerning the data.

### Comparing the results with Spool

Firstly we consider the issue of navigation matching content, then whether graphics make a difference to usability followed by the relevance of publishing concepts to WWW design.

#### Navigation matches content

The winery usability study supports the findings of the Spool's work that navigation is easier for users if the label or icon for the link reflects the content behind the link. WWW sites A and B, were rated poorly relative to the other scores for finding specific information (3.85;1.77), ease of searching (4.08;3.23) and logic of navigation (4.31;2.85) variables. They were also seen to use poor labelling for navigational links. Analysis of tester comments on likes and dislikes of the WWW site also indicate that users value easy navigation. For example, one tester commented 'information was under (the) headings I expected'. Similarly, users commented on navigation features that were less helpful such as 'no navigation at the top of pages – only the bottom', 'lack of clear direction' and 'navigation buttons – unclear to where they lead'.

### Graphics make a difference

Contrary to Spool's findings, in the winery usability study, there is a close correlation between successful searching and the quality and relevance of graphics used on the design. Furthermore there were twenty one comments out of the 120 tests done that indicated that the graphics of a site were important. For example, one tester when commenting on things they liked about the site responded 'colourful, good graphics, classy'. However, we agree with Spool that animations can be off-putting for users. For example, one tester commented 'animations irritate me'.

### Page layout and readability

In this study there is a clear relationship between page layout and usability. WWW sites that rated poorly in ease of reading consisted of pages of wordy text with few headings and little emphasis on keywords. Testers commented positively about WWW sites that featured clear text ('clean lines – consistent page format') easy reading ('text clear and easy to read'), colour schemes ('warm colours of graphics') and the appeal of the site ('logical, simple, professional look'). Testers were also clear about what they didn't like in terms of page layout and readability such as too much text ('too much text to plough through' and 'far too wordy') poor contrast in colours ('background too dark') inefficient set-out ('the look – too much space on either side of the screen and between paragraphs') and they commented it was hard to find specific information because 'headings were too vague'. These findings support the ideas of Nielsen (2000) as discussed in the literature section. They seem to contradict Spool's findings concerning page layout and readability to some extent although he may be correct about WWW design requiring white space. This study suggests that traditional publishing guidelines as for example discussed by Carroll et al. (1988) are relevant to WWW design.

### Other issues

Across all the WWW sites the scores for the variables concerning *how to use the site* and *fun to use* were relatively low. Nothing in the tester comments indicated why the fun to use variable scored lower than other variables. Testers commented positively on clear labelling of icons and links ('when you run the mouse over icon, a description is displayed'), use of simple language ('plainer language could have been used in parts') and intuitiveness ('not being able to read some information that stayed hidden until clicked').

Currency of information is one area that testers picked up on. Testers report 'frustration with the number of unavailable wines' and another tester noted that the 'news was not updated' as it still advertised an event which had passed.

The testers applauded simplicity in design. This interest in simplicity was evident in comments such as 'reasonably straight forward whilst still elegant' and 'simple words – no fancy graphics – clear definitions'.

Testers also valued useful content about the wine process, the wine itself and the events related to the wineries. They were often frustrated by a lack of information in such comments as 'cost not with wine description – would have to know to look for an order form'. The testers also commented negatively on the style of the information presented in comments such as 'imbalance of rave reviews was disconcerting'.

Testers rarely commented on speed of access if it was fast but were quick to note even the slightest hint of lag as in this comment 'a hint of slowness of access'.

### General observations

The ranking of sites in the experience and usability tables are the same. When web site users have a good experience they regard the web site as usable or vice versa. For example, in a question relating to the overall atmosphere of the web site tested, one tester commented 'it was comprehensive, enjoyable and easy to use'. This quote includes elements of both usability and experience. In other words, because users had a high opinion of certain features of a web site such as the graphics, the logic of the navigation and the readability, they enjoyed the experience of working with the site. The link between these variables may be worthy of further research.

## REFLECTION

This study supports logical navigation and structure for WWW site design. It suggests that graphics do influence usability. It also suggests that publishing design principles do apply to WWW site design. Several new factors in addition to those suggested by Spool et al. (1999) are highlighted by this study including fun, self explanatory design, currency, simplicity, completeness and access speed. These findings suggest that if you want to design a usable WWW site you should consider the following points:

- Ensure that navigational links match the content behind the links

- Use colourful, relevant, professional looking graphics
- Don't overdo white space but keep the text clean and clear and maintain contrast between background and foreground.
- Write for scanability by including useful headings and keywords
- Factor in a bit of fun
- Use a self explanatory design
- Design for currency to allow information to be readily updated
- Use simple designs
- Provide complete information in an objective manner
- Optimise access speed to the WWW site and between pages.

#### Value of usability variables

The usability variables ranked the eight WWW sites in this study in the expected order. The variables were very useful in determining the obstacles users encountered in using the sites and the variables were supported by the comments of the testers. Even though the testers were experienced in the use of the Internet and in purchasing wine, the users still encountered obstacles to achieving their goal of searching for the answer to a specific question. This suggests that WWW site usability will continue to be an issue for WWW designers, particularly as more experienced users demand even better usability. It also suggests that the usability instrument used in this study is a valid and reliable measure of the obstacles for users in using WWW pages.

#### RECOMMENDATIONS FOR FUTURE RESEARCH

Some interesting issues that are raised by this study include generalisations across industries, measuring the users initial impressions of the WWW site and the value of the tester comments in this exploratory study.

It is suggested that the make-up of a business to customer web site depends, amongst other factors, on the particular industry that the business belongs to (Spadaccini & Burn 1999). It may be interesting to repeat the study in small business industries other than wineries, and to test the potential diversity, for example, those with prospective customers with more Internet experience such as IT professionals or under 25s.

In addition to the usability of a particular WWW site, it may be important to measure the impression users pick up from different WWW site designs and look at the extent to which you can compare user expectations to owner priorities. Although impression isn't totally related to usability, it generally is the deciding factor on whether a user remains at a WWW site after initial contact. A measure for this concept is more difficult to develop. Preliminary work on customer impressions of WWW sites has already been undertaken by Singh and Dalal (1999) in applying the established principles of marketing to WWW design.

Although the site ranking process and the results for each of the variables is conclusive, much of the interesting analysis was drawn from the comments of the testers. Further qualitative studies in this area, perhaps in the form of a series of case studies may allow for a deeper analysis of WWW site usability.

#### CONCLUSION

The winery usability study has confirmed many of the findings of the corporate usability study (Spool et al. 1999) and established that usability problems are not diminished by the relevant experience of the customer. The study has also provided rich data, which will be fed back to the individual wineries to allow them to improve the usability of their WWW sites. Follow on work will analyse the answers to the four winery questions and feed back these findings to the wineries. The usefulness of the usability instrument in understanding obstacles users face in searching WWW sites has also been tested with a positive outcome. This study has provided an interesting and useful look at WWW sites from the perspective of the customer that provides a foundation to explore the issue of WWW design more deeply.

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