

A usability instrument for evaluating websites - navigation elements

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Abstract

Many small businesses websites have become an important advertising medium. However little consideration is given to how these websites might be made more effective. Many factors impact on website effectiveness, including navigation. Research here describes a usability instrument developed for evaluating small business websites and uses navigation as an example of its application. The research found that the quality of navigation does have an impact on ease-of-use of a site, user's emotional response and frustration levels and a user's intention to return to that website. The research also established the statistically significant elements that contribute to navigation.

Keywords

Usability, usability instrument, website navigation

INTRODUCTION

Among the reasons why many small business owners decide to develop a website is the apparent low cost of development, potential for the website to become part of their marketing strategy and a concern that if they don't, the business will be left behind. Dholakia and Rego (1998) argue that "the Web represents a relatively easy and extremely inexpensive way to advertise, lowering the barriers to entry for small businesses" (p. 724). The content and the design of a web page however has a direct impact on a customer's view of a business. Research by Geissler (2001) concluded that "Web site design directly influences the customer conversion process" (p.497). Geissler (2001) found that navigation was critical for facilitating interactivity with a website. Keeping a user in a website increases the marketing potential of that website. A high level of interactivity means users are exploring more of a website, leading to possible future visits and purchases (Geissler 2001). One key challenge for designers of websites is ensuring that users can easily navigate the site. The research reported in this paper describes the development of a usability evaluation instrument and how it was applied to evaluate the websites of Australian small and medium-sized businesses (SMEs). One element explored was navigation. We discuss the impact navigation factors have on a user's ability to complete a task, their overall experience of the site, the level of frustration and how easy the site overall is to use. The questions the research sought to answer in terms of navigation were:

- What are the elements that contribute to navigation?
- What impact does navigation have on the users' overall experience of the site and a user's preparedness to return to a site?

WEBSITE DESIGN AND NAVIGATION

The National Office for the Information Environment's most recent report found over 65% of people between the age of 14 and 54 were regularly using the Internet, 57% of Internet users look to the Internet for information

(NOIE 2003). In the business sector, 80% of SMEs, those defined as having 5-199 employees, were online, 28% of those were engaged in buying or selling and 36% of small businesses, those with less than 20 employees were online. Most medium-sized Australian businesses have a website (82%), with 79% of SMEs having a website to market themselves (Yellow Pages 2003). Given such significant Internet activity amongst consumers and the high level e-marketing activity SMEs engage in it is timely to examine website design, specifically the navigational aspects.

The effectiveness of websites and in particular how they deliver information and effectively market to users, depends on the designer's understanding of design and the intended audience (Geissler 2001). Failure to understand what constitutes an effective website will result in dissatisfaction from both the business and user perspective. Many SMEs have moved quickly to establish a website with little understanding of what they are trying to achieve (Fisher et al. 2000).

Navigation is a major factor in website usability. In a large study conducted by Fogg et al.(2001) among the five items on a scale measuring ease-of-use were: "The site is arranged in a way that makes sense to you. The site takes a long time to download. The site is difficult to navigate" (p.64). Navigation is a major activity performed by users interacting with websites. Research relating to user browsing activity was conducted by Byrne, et al. (1999), it involved videotaping users using the Internet over the course of a day. This data was then analysed and a taxonomy of user tasks was developed. Six general tasks in relation to Web browsing were identified, three of those tasks related specifically to navigation.

There is substantial literature to suggest that users' responses to a website and its effectiveness will be determined more by how quickly users are able to complete a task, obtain required information from a site or how easy the site is to use rather than how exciting a site is (Eighmey and McCord 1998; Gefen and Straub 2000; Siddiqui et al. 2003). Navigation is an important component of how quickly tasks can be completed. Nielsen (1999) argues that it is necessary to "have a strong sense of structure and navigation support in the site so that users know where they are, where they have been, and where they can go" (p.66).

Most businesses have websites developed primarily for electronic marketing but not necessarily e-commerce (Wen, 2001; Yellow Pages 2003). Thelwall (2000) argues there are particular problems with small business websites, amongst those problems is website design. Roy et al. (2001) found from their study of websites that "the general usability of a website has an impact on the establishment of trust" (p.395). One of the five elements they identified as impacting on usability was ease of navigation. Roy et al (2001) concluded that the usability of a website has an impact on how favourably a user views a vendor.

The literature proposes a number of reasons why effective navigation is important and the implications on the effectiveness of a website, these include:

- The higher users rate the ease-of-use of a website, the greater the credibility of the website and the business in the users' eyes. Ease of use includes navigation factors (Fogg et al. 2001; Roy, et al. 2001)
- Users will be more likely to make a transaction if the design, including navigation is effective (Tilson et al. 1998; White and Manning 1998; Aladwani 2002)
- Developing websites using human factors input requires effective navigation design and is an important factor contributing to improved user satisfaction (Kirakowski et al. 1998)
- Users will make more use of the site and more information will be distributed, if it is easily navigated (Silker and Gurak 1996)
- Users spend more time at the site if a site is effectively designed (Zhang and von Dran 2000)
- Users will discontinue use of a site if it becomes difficult to navigate or too complex or if too many clicks are needed to reach the required information (Shim et al. 2002)

The literature describes a number of elements, graphics and design features that help the user become familiar with a site thereby assisting with navigation. Table 1 describes these and the supporting literature. The elements identified in Table 1 have been used to investigate the navigational aspects of the websites.

Navigational element	Supporting literature
Size of site, larger the site more important the navigational design	Katz and Byrne (2003)

Design consistency in both navigation elements and information	Thelwall (2000), Preece et al. (2002), Cooper and Reimann (2003)
The provision of landmarks and signposts such as side bars, graphics and the clarity of navigation aids	Shneiderman (1998), Cooper and Reimann (2003), Katz and Byrne (2003)
Ease of navigation, navigation complexity	Silker, (1996) Preece et al. (2002)
The design of the text and the organisation of information content assists or hinders navigation	Shneiderman (1998), Nielsen (1999), Zhang and von Dran (2000)
Inclusion of site maps	Shneiderman (1998), Preece et al. (2002)

Table 1: Key elements in effective navigation design

USABILITY EVALUATION INSTRUMENT - DEVELOPMENT AND APPLICATION

The motivation for the development of a usability evaluation instrument for SMEs was the observation that most small businesses have little understanding of website design. Research the authors undertook earlier established that most SME owners have little idea of what they want to do with their website and do not participated actively in the design, further, not surprisingly, few if any of the business owners have had their websites evaluated or tested with users in any way (Fisher et al. 2000).

There is significant literature describing various experiments and testing that has looked at usually one or two elements of website design however few have sought to look at the interaction between the elements. This usability evaluation instrument developed includes elements relating to the design of information, ease-of-use including navigation and the appearance and graphical/visual presentation of the website.

Developing the usability evaluation instrument

The usability instrument was designed, pilot tested, refined and pilot tested again. The instrument was designed to be completed by the evaluators in less than 20 minutes, most evaluators were able to complete their evaluation in under 15 minutes. It used a combination of question types allowing data to be collected that was both quantitative and qualitative, and for comment on their answers to some questions with free text responses.

There were 16 questions where evaluators could enter a free text response. These help explain to some extent why users have problems with a particular element of a site for example as well as providing richer data that can be used to more accurately assess reactions for example negative and positive comments. The questions and statements were similar to other tests used and described in the literature.

Evaluators were asked to respond to 14 Likert scale type statements and ten questions requiring a Yes/No response. Where questions and statements were presented requiring a response on a five-point scale, 1 was rated the lowest score and 5 the highest. Table 2, describes the different research approaches reported in the literature that also investigated websites from a user's perspective. The questions used for this research were similar to those involved in other studies as indicated in Table 2.

Researcher(s)	Questions/method	Numbers
Aladwani (2002)	Investigated ease of use and usefulness. 5 point Likert type scale Strongly disagree to Strongly Agree.	387 students
Nel et al. (1999)	Used a five point scale ranging from strongly disagree to strongly agree to assess a number of variables to measure flow through a website.	36 relatively inexperienced web users
Sutcliffe (2002)	Investigated website attractiveness and usability. Used a 1-5 scale to assess a number of website elements.	9 undergraduate students
Zhang et al. (2000)	Investigated presentation, navigation and quality of Fortune 500 companies' home pages. Used a scale of 1-7 to assess these elements.	40 students
White & Manning (1998)	Research explored intention to buy from food and drink sites.	163 web users

Table 2: Other research undertaken investigating website design

It should be noted that the full set of questions and statements put to users have not been listed in this paper however a copy of the full usability instrument can be obtained at: http://www.sims.monash.edu.au/staff/jfisher/usabilityeval_04.pdf

The analysis of the questions that were used to explore the elements relating to navigation are presented in the next section.

Application of the evaluation instrument

A heuristic approach to the usability evaluation was taken. Nielsen is credited with developing the heuristic evaluation technique (Preece et al. 2002). The technique Nielsen developed is one “in which experts, guided by a set of usability principles known as heuristics, evaluate whether user interface elements, such as dialog boxes, menus, navigation structure, online help, etc., conform to the principles.” (Preece et al. 2002, 408). In our case the final usability test involved 80 students who were studying Human Computer Interaction, the curriculum included the design and conduct of a usability test. The questions evaluators were asked guided their heuristic evaluation of the interface. This is consistent with the work of others for example Nielsen and Molich (1990). Dumas and Redish (1994) examined a number of evaluation techniques and concluded that “usability testing uncovers more usability problems than other evaluation method” (p.82).

The evaluators were provided with a scenario and asked to undertake a task(s) for a site then complete the questionnaire. The questionnaire explored the user's experience and views of that site. The evaluator then moved onto the tasks for the next site. Each site was explored by at least six users (the sites that were part of the early pilot testing) through to a maximum of 43 users. A low number of evaluators is acceptable as it is in line with usability testing where it is suggested that between five and eight users will generate useful results (Nielsen and Molich, 1990). It should be noted that only two of the sites had the facility to purchase online. A diverse range of SMEs were selected. A full description of each site and the task set is described in Table 3.

Site	Description of site	Task
1. Reception Centre 1	Detailed information and pictures on the mansion's history in which the reception centre was run.	Investigate booking a birthday party.
2. Bicycle shop	Advertised bicycles, parts and repairs. Site provided links to other sites.	Investigate purchasing a bike and repairs.
3. Florist	Displayed pictures of floral arrangements for different occasions, arranged according to those occasions.	Investigate purchasing flowers.
4. Motel	Pictures of motel rooms with information relating to facilities and location.	Investigate booking a room.
5. Disabled aids	E-commerce site offering a range of products for the disabled from gifts to disabled aids.	Buy a gift for a disabled child.
6. Jewellers	Pages had pictures of watches and jewellery with some descriptions. Also provided information relating to gem stones.	Investigate purchasing a watch.
7. Reception Centre 2	Most of this site consisted of pictures of the reception rooms.	Investigate booking a birthday party.
8. Green groceries	E-commerce site offering green groceries. Users were able to select a range of fresh foods from different categories.	Buy potatoes and apples.
9. Pharmacy	Information provided on the business and products. It also has a page related to medical problems.	Investigate buying a present.
10. Leisure Centre	The site provided details on the centre's facilities, membership details etc	Find out how much it costs to join and what facilities are available.
11. Electrical	Information provided on the	Investigate the repair of a video

repair shop	business and what equipment could be repaired.	recorder.
12. Audio sales	A very visual site designed to sell audio equipment.	Investigate buying a car stereo.
13. Food seller	The company sells food for lunches and delivers in the local area.	Find out about having food delivered.

14. Bus company	Provided details about the bus company, timetables and maps of the bus routes.	Find out the best route and bus number to catch to a local school.
15. Alternative medicine	An alternative medicine and therapies business. Provided details of staff and their qualifications and details of different alternative medicine and treatments.	Find out more about kinesiology.
16. Stump removalist	The company removes stumps from properties in the local area. Provided details of what the company does and a map of the area it serves.	Investigate having a stump removed.

Table 3 Websites used in the evaluation, description and tasks

Each user was given the same scenario and tasks to complete for that site. The questionnaire was the same for all sites. Sites were evenly allocated to male and female participants. The tasks were selected based on the expectations of what could be accomplished through each individual site and its relevance for the audience. The tasks were designed to be gender neutral, for example, the task for the jewellery site was to investigate purchasing a watch, rather than an item of jewellery which may appeal more to one gender than the other. The order in which sites were tested was organised so that no one site was accessed by users exclusively either first or last.

Sixteen websites were selected belonging to SMEs in Victoria, Australia. All the websites were small in size, less than 20 pages in all but one case where there were approximately 35 pages. This allowed users to explore as much of the site as possible in a relatively short time. The businesses varied in their type. Using the AltaVista search engine the names of 12 suburbs were entered, for each suburb a list of business names was generated. Each business was then assessed against the following criteria:

- SMEs likely to employ less than 200 people
- Whether the business had a website and at most only one physical location.
- The business would be of interest to the users participating in the test.

The first pilot usability test was conducted involving 14 users and eight websites, with each user investigating four sites resulting in 52 usable responses. A second pilot was conducted and involved 20 users and another eight sites, with each user investigating three sites resulting 56 usable responses. It was found after the first test that when users investigated four sites that by the fourth site the users had lost interest. The free text responses to questions asking for comments on their answer, often were minimal or there was no comment at all for the last site evaluated. There was minimal change to the evaluation questions after the pilot trials, mainly reformatting (layout changes).

For the second pilot and final test, only three sites were allocated to each user. The final testing round was conducted involving 80 users concentrating on sites 1, 2, 5, 6, 13, 14 and 15 (the other sites were no longer available). Although the tests were conducted some months apart the computer equipment and the environment for both groups were very similar. The three tests (the two pilot and the final test) resulted in a total of 322 usable website evaluations.

User demographics

In total one hundred and fourteen users participated in evaluating the chosen sites. The users were all tertiary students of different age groups although the majority were under 25 years of age, again this is in line with other studies where students are frequently used. The vast majority of users had experience in using the Internet. When asked to rate their experience on a scale of 1 to 5 where 1 was little or no experience and 5 was very experienced, less than 2% described themselves as inexperienced and 7% described themselves as having limited experience. The mean for the male users was 3.19 and 3.28 for the female users. Of the 110 evaluators 50.7% were male and 49.7% female.

Theoretical model of navigational elements

A theoretical model describing the general principles for designing the elements relating to website navigation was developed (Table 1). Table 4 provides a list of the questions and statements put to users that were used to evaluate users' responses to those navigation elements used. It should be noted that the questions and statements

put to the users were quite general and so in places there is not an exact match. Table 4 also lists the questions asked which explored factors relating to the effectiveness of the websites from a marketing perspective. It should be noted that navigation was only one aspect of website design explored through this research.

Navigational aspect	Likert scale type questions and statements	Yes/No questions	Free text questions
Website effectiveness	How would you describe your feelings about your experience using this site? (Scale 1 Very bored to 5 Very interested)	Were you able to successfully complete the task?	If not can you please describe why. What would make you come back to this site?
Design consistency in both navigation elements and information	I found the different parts of the interface such as the icons to be consistent (Scale 1 Strongly disagree to 5 Strongly Agree)		
Provision of landmarks / signposts such as side bars, graphics and the clarity of navigation aids.	I found the graphics on the site appealing (Scale 1 Strongly disagree to 5 Strongly Agree)		What was the best/worst feature of the site?
Ease of navigation, navigation complexity	It was easy to navigate through the site. (Scale 1 Strongly disagree to 5 Strongly Agree)	Were you at any stage frustrated using the site? (Yes/No)	
The design of the text and the organisation of information content assists or hinders navigation	Sometimes there was too much information on the screen. (Scale 1 Strongly disagree to 5 Strongly Agree) The size of the text was easy to read. (Scale 1 Strongly disagree to 5 Strongly Agree) The site was easy to use (Scale 1 Strongly disagree to 5 Strongly Agree) Generally the text was displayed in a way that was easy to read. (Scale 1 Strongly disagree to 5 Strongly Agree)		

Table 4: Questions and statements used to explore the different navigation elements of websites

Analysis of results

The quantitative results were analysed using SPSS. Cross tabulations were conducted. A cross tabulation is used to demonstrate “the presence or absence of a relationship” (Bryman and Cramer 1992, p.153) A chi-squared test was applied to determine the significance of the results and to establish the strength of the relationship Pearson's *r* was used. Further a Factor Analysis was conducted to explore the relationship between the identified navigation elements. A correlation coefficient analysis was also conducted.

The collection of qualitative data is important for understanding the impact the different elements have on it users experience of a website. The qualitative data was analysed using a meta-matrix as described by Miles and Huberman (1994). A matrix “is essentially the 'crossing' of two lists, set up as rows and columns.” (1994, p.93) using the key themes identified in Table 1. The qualitative data was entered into tables and categorised according to the key themes, in this case the themes related to navigation and website appeal. The use of a meta-matrix allows data to be analysed in a number of ways. Miles and Huberman (1994, p.246-253) argue that using these techniques conclusions that generate meaning can be drawn (making and interpreting findings at different levels of inference). One of the analysis techniques used was the counting of positive and negative comments users made.

RESEARCH RESULTS

In this section we describe the results of the analysis of both the quantitative and qualitative data.

Factor Analysis

To understand the relationship between the different identified elements a factor analysis on six of the key variables was undertaken. The analysis indicated that 80% of the variance could be explained by 3 components. Tables 5 and 6 present the results.

Factor	Initial	Extraction
Text size appropriate	1.000	.796
Text display appropriate	1.000	.726
Navigation easy	1.000	.751
Site easy to use	1.000	.841
Graphics good	1.000	.428
Interface consistent	1.000	.437

Table 5: Communalities (Extraction Method: Principal Component Analysis)

Factor	Component	
	1	2
Site easy to use	.915	
Navigation easy	.842	
Interface consistent	.578	
Text size appropriate		.891
Text display appropriate		.815
Graphics good		.545

Table 6: Rotated Component Matrix (a)
(Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization)

Table 6 indicates that Factor 1 is associated with ease of use/navigation and Factor 2, presentation of the interface. The factor analysis also indicated that the amount of information on the screen and the language used are not related to the two extracted factors including navigation and so these have been removed.

Reliability analysis

To further illustrate the relationship between the navigational elements a reliability analysis was also conducted. The 5 point scale statements listed in Table 4 were tested for reliability using Cronbach's alpha. The value of 0.86 exceeds the recommended minimum value of 0.7 for Cronbach's alpha indicating a high level of reliability for the retained questions.

Cross tabulations

The results presented next summarise the results of the statistically highly significant cross tabulations ($p < 0.001$). It is suggested that the larger the data set the lower r needs to be to be considered significant (Bryman and Cramer 1992, p.172) therefore with a data set of 322 usability surveys it is reasonable to claim that a weak correlation is regarded as one where r is between 0.25 and 0.35 and a strong correlation where r is greater than 0.35.

Cross tabulations were conducted to establish if the feelings users expressed about a website were influenced by factors relating to navigation. The cross tabulations were also used to assess the influence other factors have on the effectiveness of navigation. The following strong correlations were all highly statistically significant ($p < 0.001$).

Strong correlations

- The quality of the text display has an impact on how easy a site is to navigate ($r = .393$).
- The users regarded the interface designed to be consistent they also expressed strong interest in the site ($r = .356$).
- The quality of the graphics also influenced the users interest in a site ($r =$

.376).

- The quality of the text display strongly correlated with how interested users were in a site ($r = .394$).
- Not surprising how easy a site is to use impacts also on navigation effectiveness ($r = .722$).

Weak correlations

Although all the following cross tabulations were highly statistically significant ($p < 0.00$), the following are regarded as having weak correlations.

- How consistent the interface of a website is influences the effectiveness of the navigation ($r = .325$).
- The effectiveness of the graphics also influences the effectiveness of the navigation ($r = .324$).
- The size of the text ($r = .255$) and the accessibility of the language used ($r = .241$) also both impact on ease of navigation.
- Users are more likely to complete the task where the navigation is easy ($r = .212$).
- The feelings users expressed about a site were influenced by the effectiveness of the navigation ($r = .318$).
- How easy a site is to use influences a user's feelings about a site ($r = .327$).
- The size of the text ($r = .293$) and the accessibility of the language used ($r = .285$) also impact on level of interest users expressed in a website.
- Users are more likely to complete the task where the navigation is easy ($r = .212$).

Qualitative results

Table 7 summarises the extent to which navigation had an impact on the overall effectiveness of the website as a marketing tool and supports the findings above. The sites where there were less than 15 evaluators per site have been excluded as it was not possible to meaningfully compare a count of positive and negative comments where sites had only 6 evaluators looking at that site. The bus company's website was also excluded because this was the only company that did not see its website as part of its marketing strategy. The mean scores for the items relating to ease-of-use, quality of the graphics and consistency of the interface were added together and divided by three to give a 'Rating' total. 'Navigation' is the mean for the Likert Scale statement "It was easy to navigate through the site". Website appeal is the mean for the question "How would you describe your feelings generally about your experience using this site?", where the evaluators were asked to respond on a scale of 1 Very bored to 5 Very interested. The last two columns are the total of the number of positive (P) and negative (N) comments the evaluators gave to the question "What would make you come back to this site?" the evaluators were asked to provide a free text response to this question.

Website	Rating	Navigation	Website appeal	Positive comments	Negative comments
Food outlet	4.0	4.3	3.6	25 (86%)	4 (14%)
Bike Shop	3.8	4.2	3.5	19 (68%)	9 (32%)
Reception centre	3.9	4.1	3.2	24 (83%)	5 (17%)
Alternative medicine	3.6	3.8	3.0	25 (73%)	9 (26%)
Disabled	3.4	3.8	2.8	19 (68%)	9 (32%)
Jewellers	3.1	3.7	2.3	10 (48%)	11 (52%)

Table 7: Summary of evaluator responses

Table 7 suggests a strong correlation between the items relating to navigation and users overall response to the website. How users respond to a website, as discussed earlier, is a critical component of how effective the

website is from a marketing perspective. The first three sites all ranked very highly in terms of how easy they were to navigate and were also the sites users found most appealing, this is also reflected in the number of positive comments users made of those three sites, suggesting these evaluators would return to these sites. Of the negative comments for these first three sites, only three evaluators, for each of the sites, said “nothing would bring them back to the site”.

The Alternative medicine site had minimal navigation, it consisted of a frame down one side with links to sections in a single page of text, however six of the users said that “nothing would bring them back to the site”. The Bike shop had a higher number of negative comments which generally reflected the users not being interested in buying a bicycle, three of the users said they either could not afford a bike or did not want one. Both the website selling products for the disabled and the Jewellers site attracted the most negative comments with six evaluators for both sites saying nothing would bring them back to the site and in both cases the websites were rated very poorly in terms of navigation and ease of use.

DISCUSSION

The research illustrates the importance of navigation on website design, specifically we have found:

- The elements identified in Table 1 do contribute to navigation.
- The quality of the navigation impacts on how interested users are in a website. Users are more likely to indicate boredom with a site if they do not consider the website easy to navigate. A user’s level of frustration is also strongly correlated with the quality of the navigation.
- Those elements related to navigation also influence strongly how interested a user is in a website and therefore their likelihood to return to that site. Again a strong correlation was demonstrated.
- Ease of use and navigation are, as would be expected, closely related.
- Not surprising, how easy the site is to navigate does have an impact on whether the task is completed.
- As would be expected users are more likely to complete a task on websites which they find interesting.

The research reported in the literature to date describes a variety of elements that impact on website navigation, however, there is no research the authors can find that has identified a specific set of elements that contribute exclusively to navigation. This research sought to identify and confirm those elements that assist users to effectively navigate a website, the elements confirmed through this research are: the consistency of the site, the graphic design, the clarity of the navigational aids in particular the text size and display, navigation complexity and ease of use.

CONCLUSION

Understanding users and their navigation needs are critical elements in the success of a website. In this paper we have evaluated and investigated a number of Australian SME websites with respect to their navigation and usability through the development and use of a website usability instrument. The research demonstrated how a usability instrument that is both quantitative and qualitative in design could be applied to evaluate websites.

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