Customer needs in Web based interaction: A macro view of usability

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Usable Web page design is critical for the acceptance and utility of the Internet. Pages with poor usability can have several negative effects. A recent email posting announced an "exciting, major advance" on a certain web site. In that email, the improvements discussed were described as "more powerful, simpler, faster", "easier-to-use, more logical navigation", "in-depth and in-context information" and so on. Even though all these descriptors seem important to a user, it is not clear as to whether any user can really relate to these descriptors and how related they are to each other. Our study was an attempt to understand this issue. We examined two retail and two airline industry web sites. The effect of having time limits when making transactions was also examined. Hence, there were two independent variables: Industry Type and Time Limit. Sixty-four native Hong Kong subjects aged 18 to 24 years participated in the study. These sixty-four participants were divided into two groups of thirty-two. One of the two groups had an overall time limit (15 minutes to perform all the assigned tasks) while the other group did not. Each participant was asked to use two websites (one from each industry). The analyses on the post-test questionnaires showed that web usability is governed by four important dimensions: Interaction Efficiency, Trust and Safety, Information Content and Access, and Input-Output. These four factors were able to explain most of the variation in the data. This finding has important implications in terms of website design as well as usability testing. The results may be used to simplify usability questionnaires thereby minimizing user-testing time and enhancing the user feedback information.

1. INTRODUCTION

Usable web page design is critical for the acceptance and utility of the Internet. Pages with poor usability can have several negative effects. For example, users can become frustrated from their inability to find information, confusing information displayed, pages under construction, disconnected links, lack of navigation support and so on. As a result of disorganized pages, misleading link names, long pages, and long downloading times, users' time is wasted. All of these factors not only affect the use of a certain site, but, are also largely responsible for much of the unnecessary traffic on the Internet. Poor usability of Web pages may lead to reduced visits to the site, negative feedback from frustrated users, and leave an overall negative image of the site.

Designing usable and exciting pages is not an easy task. There are various guidelines for designing usable interfaces and Web pages (Nielsen, 2000; Johnson 2000; Forsythe, Grose, & Ratner, 1998; Galitz, 1997; del Galdo & Nielsen, 1996; and Fernandes, 1995). These methods are extensive and cover various aspects of interface and Web page design. Nielsen (2000) gives a good review of fundamental errors in web page design. In addition, Fernandes (1995), del Galdo & Nielsen (1996), Lau, Shih, and Goonetilleke (2000), Shih & Goonetilleke (1998,1997), Choong & Salvendy (1998) have studied the impact of culture, language, and locale and proposed guidelines for "global" design.

Even with the use of all such guidelines, web design is almost always subject to usability testing where different characteristics are evaluated using standardized questionnaires. Every time a web site has been upgraded, there may be email announcements with words such as powerful, simpler, faster, easier to use, logical navigation capability, in-depth and in-context content and so on. The question that remains is how important is each one of these characteristics relative to each other in order to make a website exciting to use.

This study attempts to understand the "higher level" factors that are important to users.

2. METHODOLOGY

2.1 Stimulus Materials and equipment

Four websites were tested in this study: two retail and the other two related to airlines. The experiment was run using a Compucon computer, NEC multisync A700 monitor, and Genius Net Mouse Pro. The Netscape browser was used for most experiments. On some occasions, the Internet Explorer was used as the browser.

2.2 Participants

Sixty-four Hong Kong Chinese were participants in this study. Their Internet experience and other demographic information were collected at the beginning of the experiment. Participants were paid HKD 75 for their time. The experiment lasted between 1 ½ hours and 2 hours each.

2.3 Experimental Design

There were two independent variables in this study: Industry Type and Time Limit. The two industries were Airline and Retail. The sixty four participants were divided into two groups of thirty-two. One of the two groups had an overall time limit (15 minutes to perform all the assigned tasks) while the other group did not. Each participant in each group was asked to use two websites (one from each industry). The experimental design is shown in Table 1.

Table 1. Experimental Design. N refers to sample size.

		Industry / Site			
		Airlines		Retail	
		"AA"	"AB"	"RA"	"RB"
TIME	Yes	N=16	N=16	N=16	N=16
LIMIT	No	N=16	N=16	N=16	N=16

In order to balance carry-over effects, the order of testing was balanced within each of the two groups. This resulted in eight combinations within each group (AA-RA, AA-RB, AB-RA, AB-RB, RA-AA, RA-AB, RB-AA, RB-AB). Four participants were randomly assigned to each of these combinations.

2.4 Procedure

The experimental procedures were as follows:
1. The participants were briefed about the purpose of the experiment and provided the task instructions.
2. The participant was asked to sign the consent form
3. A pre-test questionnaire was then given to the participant
4. Each participant was asked to perform six tasks on one of the retail sites and four tasks on one of the airline sites.
5. After finishing the tasks, the participant was asked to complete a questionnaire on the usability of the website.
6. The participant was then asked to repeat steps 4 and 5 for the second site.
7. Participants received payment and signed a payment form.

The questionnaire was an attempt to evaluate as much information as possible about each site. A 5-point scale (1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree) was used for this purpose and the subjects' opinion was sought with respect to each of the following:

1. The website is easy to use.
2. The way that information presented in the website is easy to read.
3. Each web page contains all the necessary information to do what is required.
4. It is difficult for me to find the information I want.
5. It takes too much time for me to use the website.
6. The sequence of activities required to complete a task follows my expectation.

7. I always receive clear feedback from the system when it completes a requested action (successfully or unsuccessfully).
8. The website is well organized.
9. It is easy for me to navigate through the website.
10. The response times are too slow.
11. It is not easy for me to input (enter) information in the website.
12. I need to be very careful in order to avoid errors.
13. I like to use this website.
14. Conducting transactions on this website is safe and secure.
15. I trust this website completely.
16. I trust this COMPANY/organization completely.

3. RESULTS AND ANALYSIS

The descriptive statistics of the participants is given in Table 2.

Table 2 Descriptive Statistics of participants

Gender	Number	Mean (years)	Std. Dev. (years)	Minimum (years)	Maximum (years)
Female	27	20.63	1.043	19	23
Male	37	20.35	1.274	18	24

Table 3. Analysis of Variance results. The F value and the corresponding probability (p) value (in parenthesis) are shown for each factor.

Question number Variable	Time	Industry	Time*Industry
1-easy to use	0.15 (0.7016)	**26.89 (0.0001)** **Airline > Retail**	0.04 (0.8480)
2-readability	0.72 (0.3969)	**16.49(0.0001)** **Airline > Retail**	0.22 (0.6376)
3-contains required info	0.14 (0.7063)	**8.02 (0.0054)** **Airline > Retail**	0.04(0.8505)
4- difficult to find	1.02 (0.3149)	**17.96 (0.0001)** **Retail > Airline**	2.00 (0.1602)
5-too much time	0.71 (0.4022)	**17.02 (0.0001)** **Retail > Airline**	0.17 (0.6835)
6 – expectation	2.01 (0.1590)	**4.29 (0.0404)** **Airline > Retail**	0.30 (0.5867)
7 – feedback	0.00 (1.0000)	1.39 (0.2400)	1.90 (0.1708)
8 - organization	0.29 (0.5921)	**9.71 (0.0023)** **Airline > Retail**	0.01 (0.9146)
9 - navigation	0.10 (0.7556)	**14.80 (0.0002)** **Airline > Retail**	0.27 (0.6040)
10 - response time	1.01 (0.3160)	**31.79 (0.0001)** **Retail > Airline**	1.46 (0.2293)
11 -inputting	3.14 (0.0789)	3.14 (0.0789)	0.10 (0.7551)
12 - erroneous	1.22 (0.2721)	**16.36 (0.0001)** **Retail > Airline**	0.00 (1.0000)
13- liking	0.10 (0.7495)	**31.96 (0.0001)** **Airline > Retail**	0.10 (0.7495)
14 - safe	1.28 (0.2595)	0.40 (0.5303)	0.14 (0.7064)
15- trust website	0.56 (0.4539)	0.10 (0.7480)	0.10 (0.7480)
16- trust company	0.04 (0.8385)	1.04 (0.3091)	0.04 (0.8385)

Due to hypothesized differences between the two industries and among the four web sites, each of the questions in the post-questionnaire was subjected to a 2 (industry type) * 2 (Time Limit/No Time limit) Analysis of Variance. The results are shown in Table 3.

Since the results for many of the variables were similar, we performed a factor analysis to identify potential groups in order to explain the variability in the data. The varimax rotated factor patterns are shown in Table 4. The emergence of 4 important factors (Eigen values greater than 1) is quite significant.

Table 4. Varimax rotated factor patterns (Factor scores greater than 0.5 are shown in bold)

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
1-easy to use	**0.82**	0.15	0.24	-0.24
2-readability	**0.86**	0.03	0.13	-0.09
3-contains required info	0.33	0.14	**0.70**	-0.11
4- difficult to find	**-0.73**	-0.09	-0.16	0.05
5- too much time	**-0.70**	-0.23	0.08	0.35
6 - expectation	**0.55**	0.03	0.39	0.06
7 - feedback	0.49	0.06	-0.09	-0.15
8 - organization	**0.65**	0.17	0.45	-0.07
9 - navigation	**0.80**	0.16	0.31	-0.13
10 - response time	-0.15	-0.06	-0.04	**0.85**
11 -inputting	-0.08	0.00	**-0.63**	**0.56**
12 - erroneous	-0.40	-0.15	-0.16	**0.53**
13- liking	**0.78**	0.20	0.24	-0.23
14 - safe	0.18	**0.70**	-0.16	-0.26
15- trust website	0.17	**0.86**	0.13	-0.08
16- trust company	0.06	**0.69**	0.44	0.14
Variance Explained	5.02	1.93	1.78	1.71

4. DISCUSSION AND CONCLUSIONS

A significant difference (p < 0.05) exists between the Retail and Airline sites for most post-test questionnaire variables. In general, participants favored the retail sites in terms of easy of use, readability, information content, time taken, organization, navigation, response time, general liking and inputting information. For example, more than 75% of the participants felt that the two retail sites were easy to use. However, not more than 30% of the subjects felt that the two airlines sites were easy to use. Interestingly, no significant differences exist between retail and airlines in terms of safety, trusting the company or trusting the website. This is somewhat an indicator that the differences for the usability related variables are primarily as a result of site design, organization and the amount of help provided to guide the user in performing the tasks. It is true that most of the post-test questionnaire variables are somewhat correlated. To avoid repetition and to scale down the problem, it is always useful to categorize all the variables into a set of critical "dimensions".

The factor analysis helped in grouping the variables (Table 4). The variability in the data among the sites can be explained with four basic factors. The emergence of four factors (four dimensions) can give a broad view of a web site (Table 4). Factor 1 loadings are dominated by easy of use, readability, difficulty of finding information, time taken to find information, expectation, organization, navigation and general liking. Factor 2 is dominated by safety, trusting web site and trusting company. Factor 3 by information contained and the information input and lastly Factor 4 by response time, errors, and information input. Based on these variables, Factor 1 can be labeled as "*interaction efficiency*", Factor 2 as "*trust and safety*", Factor 3 as "*information content and access*" and Factor 4 as

"*input-output*". Site improvement announcements that we receive through email almost every day capture most of these aspects but give little information towards a coherent model for the web-designer. Even though the Max model proposed by Lynch, Palmiter and Tilt (1999) has built-in the general system characteristics, it is not complete in terms of the interaction or usability as many factors related to interaction have to be deduced based on the block model proposed. As an introductory study exploring the characteristics of two different industry sites, this study has provided valuable insights for usability testing. More work is required not only to identify the problems in site design but also to generate designs based on task analyses and cognitive mappings.

ACKNOWLEDGMENTS

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Usability Evaluation and Interface Design

Cognitive Engineering, Intelligent Agents and Virtual Reality

Volume 1

Edited by

Michael J. Smith • Gavriel Salvendy
Don Harris • Richard J. Koubek