

The use of factor analysis for evaluating mediative websites

Theofanidis Faidon

Lecturer at Department of Business Administration University of Patras
theofan@upatras.gr

Pavlis Nikolaos, Ph.D

Department of Industrial Management University of Piraeus
npavlis@unipi.gr

Daskalopoulos Evangelos, Ph.D Candidate

Department of Business Administration University of Patras
adaskalop@upatras.gr

Abstract

Nowadays, for the majority of Greek people, internet occupies a major part of their everyday life, both at home and/or at work. In the "world of Internet", users, from a commercial point of view, equals consumers, and thus it is significant to understand their expectations from websites. This study introduces several criteria for evaluating mediative websites. In the first part, we identify the evaluation criteria that can be used for the evaluation of mediative websites. Then, selected criteria were used by 217 Internet users to evaluate three specific mediative websites: www.skillshare.com, www.carpooling.gr and www.airbnb.com. In the second part of the paper all the independent evaluation criteria were factor analyzed for all three mediative websites to further investigate how the variables-criteria correlate and group together creating specific evaluation patterns. Findings of the study designate six main factors of website evaluation in ranking order: First is the design of the website, second is navigation, third is interaction, then applications, content and finally credibility. The authors discuss the implications of the study for web site designers and identify avenues for future research.

Keywords: Website Quality, Website Evaluation, Customer Satisfaction, E-commerce, Factor Analysis

Introduction

In the "world" of commercial websites, users are consumers. It is crucial to understand consumers' expectations and how they feel about the websites they use. Literature proposes many models for website evaluation based on the kind, the genre, the goals, and the audience. This research, takes into account six well known criteria for website evaluation: (1) Design, (2) Content, (3) Navigation, (4) Credibility, (5) Interaction and (6) Applications.

Furthermore, we discuss the methodology regarding the conduction of an internet survey, addressing specific questions in order to investigate and evaluate mediative websites from the perspective of a new user.

Descriptive statistics methods are used to explore how the chosen websites perform according to selected evaluation criteria and factor analysis is employed in order to further investigate the evaluation patterns.

Literature review

According to literature review there are six main categories of web site evaluation criteria:

Design

An attractive designing is based on elements of graphic appearance and multimedia provided. Specifically elements such as, the correct text, the existence of maps, videos and images are of great significance for a website (Barry and Lang, 2001). Using the right colors, layout and background to make them visually accessible, motivates the visitor to become a frequent user (Lindsay, 1999; Ivory& Hearst 2002). Furthermore, it is evaluated whether the font is readable for the visitor, the suitability of the text size and if the contrast between the background and the text leads to easy reading. Essential features for helping foresighted people such as voice help, or zooming are also a crucial element of evaluation (W3C, 2001). Graphic design is evaluated as to whether it provides the frame for providing all the necessary information to the end user, pleasantly and with comfort. Technology can be too complicated or too sophisticated for certain populations. An important rule that must be followed is the so called law of Nielsen, who refers to the expectations of the users : *"The users spend a lot of time to other internet nodes and therefore have formed their own understanding and have their own expectations on how the Web is used"* (Del Galdo E. & Nielsen J.,1996).

Content

Content is basically evaluated whether the information given by the site is enough or not. The quality of information regarding products or services is also evaluated. (Mervwe R. & Bekker J., 2003). It is also evaluated on how correct and updated the site is. Besides, continuous updating, marking the new information and the proper archive of old information, are necessary. Data regarding the authors of the site are very important. Large scrolling pages reduce the chance that a user might read the content which is not visible in the page, resulting in repulsion of users. Large text should be used as headings and subheadings, while highlighted words and short paragraphs can attract the user attention to read important data.

Navigation

Regarding navigation, the existence of a map is highly evaluated by the user, as well as the existence of an operational search engine. A navigational map improves navigation of the users and provides a sensible structure that helps the user to follow a sensible path (Oppenheim C. & Ward L., 2005). An important element of navigation is to navigate through the new and the old, through the fashioned and popular or to more specific information. Users like clear navigational maps (Mervwe R. & Bekker J., 2003).

Credibility

The extent of reliability of the site, as well as the degree of maintaining security and secrecy, are important elements for user's trust (Cox J., Dale B.G., 2002). Trust is about the level of customers belief that the site is ethical, credible, legal and also capable of protecting their privacy (Wan,2000). Thus, it is very

important for system designers to comprehend the consequences of accumulating frustration, particularly because the users are more likely to proceed with a purchase in the final levels of interaction (Bhatti et al., 2000).

Interaction

The interaction between the user and the site is an important factor of positive evaluation of the site. In several sites on-line contact is possible at any time of the day (24 hours availability). Furthermore, each visitor can be informed about various interactive multimedia applications. The active participation of users, the existence of e-mail lists, the sending of newsletters, and the existence of visitor community for communication and opinion exchange, are important criteria for choosing a webpage.

The option for users to customize their favorite websites according to their needs or style is very essential. For example, the users must be able to view the site in their preferred language (Oppenheim C. & Ward L.,2005). Also, it is useful to facilitate people with specific individual needs (impaired vision, hearing, etc.) with services that can be provided. Moreover, the existence of elements that encourage future users such as sending newsletters and a visitor community for communication and opinion exchange, are an advantage for the site because they work as promotional techniques (Oppenheim C. & Ward L.,2005).

Applications

Applications can be either useful or annoying to end users. It is an essential part of websites that needs to be evaluated. The existence or inexistence of advertisements (ads) and popup windows (popups) and their usefulness, the existence of application of a website in 'smart phones'', and finally, the existence of a 'hit-counter''.

Methodology

This study presents the results of a survey in which internet users evaluated three specific mediative websites. The term mediative means: to serve as a medium for causing (a result) or transferring (objects, information, knowledge etc.) The three mediative web sites which were evaluated are: (a) www.carpooling.com, (b)www.skillshare.com and (c) www.airbnb.com.

The type of the survey was exploratory and was based on the collection of primary data. The questionnaire contained 97 questions and was distributed electronically via email and answered by 217 Internet users between the ages of 18-55 years. The research took place from 05/31/12 to 05/07/12. There was no sampling frame. The determination of the sampling frame is required when the sample is a probability sample. (Kouremenos 2001). This survey used non probability sampling and more specific a convenience sample.

Electronic data collection (via email) was considered appropriate due to the nature of the survey (evaluation of mediative websites). Furthermore, the choice of an online survey, over other kinds of surveys, facilitated the collection process, reduced processing time, provided on line support of the respondent by a qualified researcher and more important coordinated, monitored and checked the individual answers.

So, based on extensive literature review a categorization of the survey variables into thematic sessions has been made. Emphasis was given to the wording of questions in each thematic session, especially regarding website evaluation in order to avoid comprehension problems of advanced terminology. For issues of convenience, the three chosen mediative websites didn't require a username or password so each visitor, could have a general overview (not as a user requiring to sign in) before participating in the survey. The final version of the questionnaire was extensively pre-tested with 20 internet users and no specific problems appeared with respect to the measures, the clarity of the questions or the length of the questionnaire.

The final questionnaire was sent via email along with a cover letter. The cover letter was incorporated into the first page of the questionnaire explaining the survey purpose and giving instructions for completing the questionnaire (Kouremenos 2001).

The final questionnaire was comprised of four important categories of variables:

Demographic Characteristics: Includes questions related to gender, age, education level, occupation and residence.

Economic Characteristics: Includes questions related to the main type of employment and respondents' income.

Internet Usage: Includes questions related to social networks, time spent on internet and also the place from where users connected to the internet.

Website Evaluation Criteria: This section includes questions related to the evaluation of the three mediative websites. The questions are related mainly to the design of the website, the colors used and the contrast between them, the structure of the text, the content of the site and its updates, navigation, quality of the search engine, the services and applications, the tools to attract users, the usability and the degree of confidentiality towards any website.

It is important to mention that the questionnaire was considered by most respondents interesting, readable and they had a positive attitude in participating in the survey. Also, users had the ability to communicate directly with one of the researchers through the online chat of facebook, messenger and via email, for clarifications. The majority of questions in the questionnaire were closed-type and Likert five-point scales were used. More specifically, the Likert scale which was used had 5 points, where option 1 means "not at all" and option 5 means "very much". According to Boote (1981), the scales should be limited to 5-7 points. Therefore, it was considered that a scale with five points would be more appropriate for the researcher, but also convenient to the respondents. Most research constructs are measured using existing, well validated scales, which were identified after a thorough review of the pertinent literature.

Mediative Websites under evaluation

Skillshare is a website in which anyone can learn anything from anyone. Its founders believe that anyone who knows something (e.g. foreign language, musical instrument, scientific skill etc.), can share their knowledge by teaching others. This makes knowledge

transfer very fast. This platform helps making the exchange of knowledge easy and fun.

Carpooling is a website that connects people who want to make a trip or move and share travel expenses. Initially, it is required to register on the site, and next make an announcement of the trip. Drivers and passengers will be informed by the website and can agree without website's intervention. Basically the site serves as a mean of demand and supply on transport or traveling.

Airbnb was founded in August 2008 and is based in San Francisco, California. This website serves those people who are interested in traveling anywhere and stay in accommodation anywhere on the planet. Approximately 19,000 cities and 192 countries of the world are on the website.

Results of Descriptive Statistics

Of the total sample, 52.5% were women, 47.5% were men, and the average age is 26.82 years. 35.9% were university students, 20.7% were private employees, 18.9% were self-employed, 11.5% were public servants and 13% were unemployed. In terms of educational level: 4.1% were PhD holders, 20.3% were Master degree holders, 64.5% had a Bachelor, 10.6% had graduated from secondary education and only 0.5% were graduates from primary education.

Regarding the economic characteristics of the sample, 52.1% declared a monthly income of 0-500 euro, 31.8% answered 501-1,000€, 10.1% stated 1,001-1,500€, while 3.7% and 1.4% answered: 1,501-2,000€ and 2,001- 2,500€ respectively. Finally, 0.9% answered that their monthly income is greater than 2,501€.

The 95.4% of the sample uses internet at home. The 15.2% of the sample connects to the Internet from places that provide a wireless network (not at home), 22.6% use mobile Internet and only 0.9% connects to the internet from an internet café. Of the total respondents, 96.3% have an account on, at least, one social networking website. We should also note that 94.5% of respondents have an account on Facebook. In second place is Youtube with 45.6%. Furthermore, 24.4% have personal accounts at Twitter, 19.8% at GooglePlus, 13.8% at LinkedIn, 10.1% at Wikipedia, 7.4% at Myspace, and only 5.1% at Hi5. It is worth mentioning that the average daily use of the internet is 5.27 hours. Respondents use Internet on a daily basis and spend a big amount of their time on Internet, therefore, the evaluation of the mediative websites was basically done by experienced users.

Table 1 contains the means of sample responses on specific evaluation criteria. www.airbnb.com website displays the highest average of answers on questions related to design. This indicates the user satisfaction level regarding the design of the particular website in comparison to others. Second place goes to www.skillshare.com, and last is www.carpooling.com. Specifically, the means of the question "how much attractive do you consider the design?" were: airbnb 3.93, followed by 3.35 (skillshare) and 3.20 (carpooling).

Regarding content, airbnb holds the first place. Specifically, regarding content update, the average is 4.01, followed by carpooling with 3.88 and finally skillshare with 3.73. These results have a reasonable explanation, because the types of services offered by all

three websites lead to increased and continuous user requirements for updating the content as often as possible. Users' preference towards the airbnb about satisfactory navigation is obvious. Between carpooling and skillshare though, the distinction is not quite clear. Regarding the satisfactory user interaction with each website the highest place belongs to airbnb once again. Specifically, when asked about likelihood of account creation, it displays an average of 3.30 (versus 2.97 and 2.90), and the possibility to invite a friend has a mean of 3.39 (versus 3.11 - carpooling and 2.90 - skillshare). In the catalytic question "how handy do you consider the website" first is airbnb averaging 3.92, followed by carpooling and skillshare with averages 3.56 and 3.46 respectively. Regarding the existence and utility of applications and functions, airbnb displays the largest scores.

Table 1: Evaluation of websites using specific criteria
(sample means, scale: 1=low evaluation 5=high evaluation)

Website	Design attractiveness	Visibly accessible colours	Size of text	Legible font	Contrast (colour)	Update	About us	Upload
<i>skillshare</i>	3.35	3.55	3.84	3.84	3.69	3.73	4.02	3.06
<i>carpooling</i>	3.20	3.31	3.29	3.34	3.41	3.88	3.88	3.10
<i>airbnb</i>	3.93	3.89	3.88	3.87	3.92	4.01	3.95	3.31

Website	Text structure	Perceived purpose	Site map	Search engine	Active links	Quick search	Tools that attract users	Usability
<i>skillshare</i>	3.76	3.12	3.63	4.29	3.75	4.17	3.38	3.46
<i>carpooling</i>	3.44	3.81	3.68	4.14	3.68	4.09	3.38	3.56
<i>airbnb</i>	3.83	3.97	3.85	4.21	3.90	4.24	3.67	3.92

Website	Smartphone applications	Hit-counter	Translation in other languages	Existence of ads	Account creation	Invite a friend	Personal details	Use a Credit card
<i>skillshare</i>	3.41	3.18	4.09	3.03	2.90	2.90	2.56	2.11
<i>carpooling</i>	3.74	3.28	3.82	3.14	2.97	3.11	2.56	2.08
<i>airbnb</i>	3.77	3.46	4.06	3.32	3.30	3.39	2.74	2.37

Results and Discussion of Factor Analysis

The purpose of this survey is to evaluate three mediative websites using specific criteria selected after extensive literature review. Descriptive statistics provided useful information about the characteristics of the sample and users' evaluations of these websites using specific criteria.

In order to further investigate how the variables-criteria correlate and group, we used factor analysis. The primary goal is to reduce a large number of variables into a smaller number of important factors. Furthermore, the goal was to identify any correlations between research variables and how they load on specific factors.

Data have been analyzed using exploratory factor analysis to extract the underlying factors of website evaluation. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity

(BTS) has been calculated. All factors have been extracted using orthogonal varimax rotation. Only the factors having latent roots or eigenvalues greater than 1 were considered significant, were retained and reported.

I. www.skillshare.com

Regarding the mediative website of skillshare, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is 0.833, which is above the recommended 0.5 level (Malhotra, 2008). The Bartlett's Test of Sphericity (BTS) gives approximate chi-square statistic 1631.79838 with 253 degrees of freedom, which is significant at the .01 level.

Table 2: Factor analysis of the evaluation criteria of www.skillshare.com

Factor	Percent of variance	Variable	Factor loading
1. Design	26.488%	Legible font	0.797
		Text size	0.780
		Contrast	0.715
		Visibly access colors	0.680
		Design attractiveness	0,535
2. Interaction	8.784%	Account creation	0.814
		Invite a friend	0.763
		Upload	0.559
		Usability	0.433
3.Navigation	7.551%	Site map	0.660
		Perceived purpose	0.637
		Tools that attract users	0.554
		Search engine	0.547
		Quick search	0.541
4. Applications	6.534%	Hit counter	0.732
		Smartphone application	0.669
		Existence of ads	0.640
		Translation in other language	0.624
5. Content	5.406%	About us	0.727
		Update	0.712
		Text structure	0.517
6. Credibility	4.990%	Credit card	0.870
		Personal details	0.829

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.833

Bartlett Test of Sphericity = 1631.798, Significance = 0.000

"Design" (Factor 1) accounts for 26.488% of the total variance in the data. Factor 1 consists of five variables with significant positive factor loadings: Legible font (0.797), Size of text (0.780), Contrast (colors) (0.715), Visibly accessible colors (0.680) and Design attractiveness (0.535). "Interaction" (Factor 2) accounts for 8.784% of the total variance and includes four variables with significant positive factor loadings: Account creation (0.814), Invite a friend (0.763), Upload (0.559) and Usability (0.433). The third factor is "Navigation" (Factor 3) and accounts for 7.551% of the total variance. Factor 3 consists of five variables with positive factor loadings: Site map(0.660), Perceived purpose (0.637), Tools that attract users (0.554), Search engine (0.547) and Quick search (0.541). "Applications" (Factor 4) accounts for the 6.534% of the total variance. Factor 4 consists of four variables with significant positive factor loadings: Hit counter(0.732), Smartphone application (0.669), Existence of advertisements (0.640)and Translations in other languages (0.624). "Content" (Factor 5), accounts for 5.406% of the total variance and consists of three variables with positive factor

loadings: About us(0.727), Update (0.712) and Text structure (0.517). Finally, the last factor is "Credibility" (Factor 6) which accounts for 4.990% of the total variance in the data and consists of two variables with significant positive factor loadings: credit card(0.870) and Personal details (0.829). The cumulative percentage of total variance extracted by the six successive factors (presented above) is 59.753%, indicating that the component analysis factor model is satisfactory.

II. www.carpooling.gr

Regarding the mediative website of Carpooling, Kaiser-Meyer-Olkin (KMO) measure is 0.901 (well above the recommended 0.5 level). The Bartlett's Test of Sphericity (BTS) gives approximate chi-square statistic 2748.825 with 276 degrees of freedom, which is significant at the .01 level.

Table 3: Factor analysis of the evaluation criteria of www.carpooling.gr

Factor	Percent of variance	Variable	Factor loading
1. Design	33.858%	Text size	0.876
		Legible font	0.857
		Contrast (color)	0.777
		Visibly access colors	0.757
		Text structure	0.656
		Design attractiveness	0.626
2. Navigation-Content	8.433%	Search engine	0.737
		About us	0.708
		Update	0.658
		Quick search	0.618
		Active links	0.580
		Site map	0.542
		Perceived purpose	0.522
3. Interaction	7.607%	Invite friend	0.839
		Account creation	0.833
		Upload	0.642
		Usability	0.629
		Smartphone application	0.494
		Tools that attract users	0.470
4. Applications	5.906%	Hit counter	0.759
		Existence of ads	0.715
		Translation in other language	0.577
5. Credibility	4.757%	Personal details	0.840
		Credit card	0.797

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.901

Bartlett Test of Sphericity = 2748.825, Significance = 0.000

"Design" (Factor 1) accounts for 33.858% of the total variance in the data. Factor 1 consists of six variables with significant positive factor loadings: Text size (0.876), Legible font(0.857), Contrast (colors) (0.777), Visibly accessible colors (0.757), text structure (0.656) and Design attractiveness (0.626). "Navigation and Content" (Factor 2) accounts for 8.433% of the total variance and includes seven variables with significant positive factor loadings: Search engine (0.737), About us (0.708), Update (0.658), Quick search (0.618), Active links (0.580), Site map (0.542) and Perceived purpose (0.522). The third factor is "Interaction" (Factor 3) and accounts for 7.607% of the total variance. Factor 3 consists of six variables with positive factor loadings: Invite friend(0.839), Account creation

(0.833), Upload (0.642), Usability (0.629), Smartphone application (0.494) and tools that attract users (0.470). "Applications" (Factor 4) accounts for the 5.906% of the total variance. Factor 4 consists of three variables with significant positive factor loadings: Hit counter (0.759), Existence of ads (0.715) and Translations in other languages (0.577). Finally, the last factor is "Credibility" (Factor 5) which accounts for 4.757% of the total variance in the data and consists of two variables with significant positive factor loadings: Personal details (0.840) and Credit card (0.797). The cumulative percentage of total variance extracted by the five successive factors (presented above) is 63.560%, indicating that the component analysis factor model is satisfactory.

III. www.airbnb.com

Regarding the mediative website of Airbnb, Kaiser-Meyer-Olkin (KMO) measure is 0.904 (well above the recommended 0.5 level). The Bartlett's Test of Sphericity (BTS) gives approximate chi-square statistic 2748.825 with 276 degrees of freedom, which is significant at the .01 level.

Table 4: Factor analysis of the evaluation criteria of www.airbnb.com

Factor	Percent of variance	Variable	Factor loading
1. Design	39.146%	Text size	0.837
		Legible font	0.828
		Visibly access colors	0.797
		Contrast (colors)	0.752
		Design attractiveness	0.723
		Usability	0.614
		Text structure	0.611
		Search engine	0.585
		Perceived Purpose	0.553
		Active links	0.538
		Quick search	0.481
		Update	0.470
2. Navigation-Application	8.681%	Hit counter	0.775
		Existence of ads	0.711
		Translation in other languages	0.519
		Site map	0.519
		Smartphone application	0.510
		About us	0.496
3. Interaction	6.931%	Invite friend	0.902
		Account creation	0.887
		Upload	0.617
		Tools that attract users	0.481
4. Credibility	4.919%	Credit card	0.885
		Personal training	0.860

Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.904

Bartlett Test of Sphericity = 2861.778, Significance = 0.000

"Design" (Factor 1) accounts for 39.146% of the total variance in the data. Factor 1 consists of twelve variables with significant positive factor loadings: Text size (0.837), legible font (0.828), Visibly accessible colours (0.797), contrast colour (0.752), design attractiveness (0.723), usability (0.614), text structure (0.611), search engine (0.585), perceived purpose (0.553), active links (0.538), quick search (0.481) and update (0.470). "Navigation and Application" (Factor 2) accounts for 8.681% of the total variance and

includes six variables with significant positive factor loadings: hit counter (0.775), existence of advertisement (0.711), translations in other languages (0.519), site map (0.519), smartphones application (0.510) and about us (0.496). (Factor 3) accounts for 6.931% of the total variance. Factor 3 consists of four variables with positive factor loadings: invite friend(0.902), account creation (0.887), upload (0.617) and tools that attract users (0.481). ". Final the last factor is "Credibility" (Factor 4) accounts for 4.919% of the total variance in the data and consists of two variables with significant positive factor loadings: credit card(0.885) and personal details (0.860). The cumulative percentage of total variance extracted by the four successive factors (presented above) is 59.677%, indicating that the component analysis factor model is satisfactory.

Summing up, the three websites share common evaluation criteria, such as design interaction and application, which are ranked as the most important. The factor of Design accounts for 26,48%, 33.85% and 39.14% of the total variance in the data for skillshare, carpooling and airbnb respectively. Whereas, design seems to be the ultimate factor for meditative websites evaluation, the second group of evaluation criteria presents some differences among the three sites. For skillshare the second evaluation factor is Interaction which accounts for the 8.784% of the total variance whereas, Carpooling and Airbnb share the second evaluation factor of Navigation which accounts for 8.433% and 8.681% of the total variance in the sample respectively. Credibility seems to be the least important factor of evaluation based on the score of the total variance explained (skillshare 4.99%, Carpooling 4.757% and Airbnb 4.919%).

Conclusion

Generally speaking, the groups of the website evaluation criteria that emerged from factor analysis coincide with the existing categories of the current literature. With some exceptions the number of factors that came up was not the same for every website, although they coincide in several elements.

The three sites have presented completely different content and functions. This empirical research presented similarities and differences in the evaluation of websites. The design and all the elements it includes comprise the main component for a website, which goal is to attract as many users as possible. One of the similarities regarding the significance of the evaluation criteria was the design of the website, which has a leading role among other evaluation factors. Navigation is ranked as the second factor in the two of the three sites. The content factor varies a lot between the three sites. This fact has a reasonable explanation because of the differences in scope and purposes among the three selected meditative websites. Finally, it is very interesting the fact that the credibility factor ranked last at all three websites. This indicates that people (users) who participate at meditative websites are very likely to trust each other (social interaction), therefore credibility is not a very important factor to worry about.

Future Research Avenues

This survey is indicative for evaluating purposes of meditative websites in general. An attempt to approach the evaluating elements-criteria was made, based on current literature and combined with

empirical elements that were considered to be of significant importance. The purpose of the evaluation is to achieve the optimum quality of website services and maximum user satisfaction. Despite the effort for criteria objectivity, there is still human subjectivity. It is necessary to add, or to modify or even replace some evaluation elements-criteria to ensure greater objectivity and reliability during the evaluation process.

The conduction of a wider survey may include further evaluation ways and evaluation factors-criteria. A possible alternative study could include different target audiences, e.g. different educational levels or by a larger (geographical) extent (e.g. nationwide, continental or global range). It could also be directed only towards users who are members of specific sites and not new users (who were the subjects of our survey). Alternatively, there are a lot of data available from the mediative websites, which could be processed differently, using different statistical methods or other techniques. For example, we could use confirmatory factor analysis, linear regression, cluster analysis or reliability analysis regarding the research purpose and the nature of the available data.

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