An Investigation of User-Experience Design of E-Commerce Websites

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Abstract- This paper aimed to identify and compare user experience issues and provide suggestions for the three e-commerce websites. The websites were evaluated through heuristic evaluation and usability testing methods. Based on the heuristic evaluation findings, six typical task scenarios were generated for usability testing. A total of 36 users participated in the study. The participants' performances for user testing were evaluated in terms of task completion time, success rate, and number of page views by traditional usability testing. Additionally, a post-test questionnaire was administered. Statistical analysis results indicated a significant ´website-design´ effect on task completion times. Overall, the task completion time significantly varied among the three e-commerce websites. Notably, ´gender´ and internet use frequency´ had no significant effect on task completion times for all the tasks. Re-design recommendations are provided for a sample of cases.

Keywords: E-commerce, User experience, Web usability, Heuristic evaluation, User testing

1. Introduction

The number of retailers going online is increasing speedily in this ever-expanding world of online business. In this environment, the websites are the only representatives of the companies. However, the quality of these websites and their customer satisfaction levels are debatable. Although there are different factors affecting the performance of online retailers such as shipping, product quality and customer services, the user experience of websites plays a major role in online shopping business.

Improving the design of an e-commerce website in terms of user experience builds a competitive advantage by satisfying and improving the customer experience in shopping related matters. Even though website design is not a very complex task that anyone with a basic know-how of computer can carry out, creating a good website in terms of usability, user experience, and HCI principles is a rather difficult task. Due to a number of deficiencies in the website designs, customers are facing problems and are either unnecessarily spending so much of their valuable time, or giving up the use of the sites. The common website design deficiencies as identified by Nielsen (2013) are still prevalent today. Successful website design, among other factors, should consider two important factors: (i) characteristics of users: needs, abilities and limitations of different user groups (e.g.; gender, age, education, familiarity); and (ii) learning factor, which is related to use frequency of a specific website and internet use experience (e.g.; Jordan, 1998; U.S. Dept. of Health and Human Services, 2006).

Current literature on usability and user experience focuses on general guidelines for the Internet. However, there is a need of usability and user experience guidelines applicable to specific types of websites (Bainbridge, 2003). Case studies are needed to identify the research needs and user experience issues related to the current websites so that specific design guidelines can be developed for the specific websites, such as e-commerce websites.

In this paper, a usability case study was performed to identify various user experience issues and develop recommendations that would improve the websites of the three e-commerce companies, operating in the private shopping category, in Turkey: Markafoni (markafoni.com), Trendyol (trendyol.com) and Limango (limango.com). An initial study revealed that even though these are among the most used websites, there are a number of shortcomings in usability area of the sites.

Methodology and findings from heuristic evaluation and user testing are presented along with recommendations that would enhance user experience of the sites.

2. Objectives
The objectives of this study were:
- Identify high-level UI design issues about the airline websites by conducting a heuristic evaluation
- Conduct a usability study to identify the details about the high-level issues found by the heuristic evaluation
- Provide recommendations for the identified usability issues discovered via usability tests.

3. Methodology
The study consisted of the following steps that ultimately prepared a means to execute the user experience study on the three e-commerce websites.

3. 1. Heuristic Evaluation
Firstly, to identify e-commerce websites' user experience, the structures of the three websites were carefully analyzed by three evaluators who were somewhat knowledgeable of user experience principles. The understanding of the structures of the websites leads to better design of the usability testing procedure and tasks. The investigation of e-commerce websites via constructed functional diagrams led to the division of the websites experience into four main parts: discovery, browsing, check-out and after check-out. For the heuristic evaluation of the websites of the three e-commerce companies, the guidelines provided by U.S. Department of Health and Human Services in Research-Based Web Design & Usability Guideline (2006); and Nielsen´s heuristic evaluation principles (Nielsen, 1993) were utilized. User experience issues with the designs were identified. Based on the identified major issues, six typical tasks covering all four parts were tailored for user testing.

3. 2. Tasks
The determined tasks were as follows:
1. Browse the website and find a pair of black shoes for winter. Your budget is 100 TL. Add it to the basket.
2. You changed your mind about the shoes. Now, remove the product from the basket.
3. Now you want to purchase a white shirt. Again, your budget is 100 TL. Add the product to your basket.
4. Check-out. Enter the credit card information:
   > CC Number: xxxx xxxx xxxx xxxx
   > Security Code: xxx
   > Valid Until: xx/xx
5. You want to check the status of your past orders; find the related page.
6. You want to know how to return the product you ordered, find the related information.

First three tasks are browsing related tasks, Task 4 is checkout and last two tasks are after checkout related tasks.

3. 3. Participants
A total of 36 (20 female and 16 male with ages 18 to 55 years) users participated in the study. Five of the participants were high school and 31 of them were university graduates. Participants´ internet use frequency data are depicted in Table 1. All users were using internet more than one hour a day. Internet shopping experience level and experience with the considered websites of the participants are depicted in Table 2 and Table 3.

Table 1. Internet use frequency of the participants

Internet use frequency	No. of participants			
	Overall	Markafoni	Trendyol	Limango
More than 8 hours a day	8	3	3	2
More than 4 up to 8 hours a day	14	2	7	5
More than 1 up to 4 hours a day	12	7	2	3
Once a day up to 1 hour	2	1		1

Table 2. Online shopping frequency of the participants

Shopping frequency	No. of participants			
	Overall	Markafoni	Trendyol	Limango
At least once a week	3	1	2	0
At least once a month	14	2	5	7
Once every three months	13	5	4	4
Longer than three	4	4	0	0
Never	2	0	1	1

Table 3. Use frequency of the considered websites

Website use frequency	No. of participants			
	Overall	Markafoni	Trendyol	Limango
Everyday	3	1	1	1
At least once a week	5	1	1	3
At least once a month	6	2	2	2
Once every three months	6	2	1	3
Longer than three months	2	1	1	0
Never	14	5	6	3

3. 4. Pre-Test Questionnaire

The survey asked the participants to provide information on the following: gender, age, education level, daily internet use frequency, online shopping experience and familiarity with the considered websites.

3. 5. Pilot Study

A pilot study was performed with two participants to determine whether there was an issue with the tailored tasks, post-test questionnaire and test procedure so the necessary improvement would be made before the actual user testing. The pilot study also provided an opportunity for the experimenter to become familiar with the test procedure. Some minor errors were faced in the tasks that may could lead the users to ambiguity or misunderstanding. After correction of wording and other miscellaneous problems faced during pilot studies, we agreed on appropriateness of the tasks. Then user recruitment has been done and tests have been scheduled.

3. 6. User Testing

The 36 participants performed the six tasks randomly on the randomly assigned company's website. A 5-minute break is given after each task completion. The descriptive statistics of the values of each user

performance variables were recorded. The performance variables were as follows: *task completion time*, *number of page views, success rate (or failure or abandon)*. In order to overcome the negative effect of probable inadequacies in English, all the users were tested in Turkish. However, in this paper, tasks are described in English. The usability testing was performed in-person (traditional approach).

3. 7. Post-Test Questionnaire and Debriefing

The survey contained a questionnaire for the participants to fill out upon completion of each task of the usability test. After the completion of each task, the participants rated the ease of each task using a Likert scale (-3 -2 -1 0 1 2 3; where -3 corresponds to "very difficult", 3 corresponds to "very easy" and 0 corresponds to "neutral") (Table 3). Additionally, the participants were asked five evaluation questions to rate the usability of the website on a Likert scale (-3 -2 -1 0 1 2 3; where -3 corresponds to "strongly disagree", 3 corresponds to "strongly agree" and 0 corresponds to "neutral") and open-ended questions about their experience with the website interfaces.

3. 8. Statistical Analysis of the Data

Descriptive and inferential statistical analyses were performed to summarize data and determine the factor effects on the response variable (the task completion time). The effects of three factors (web-design of company, gender and internet use frequency) on the task completion time of the tasks were investigated with ANOVA and Tukey's multiple comparison tests using Minitab (v.16) statistical package. For all comparisons, $p \leq 0.05$ was accepted as statistically significant.

4. Results

4. 1. Heuristic Evaluation

A sample of findings through heuristic evaluation performed by three evaluators is shown in Table 4. It is obvious that some main principles of web design for usability were not followed by the web designers of the three e-commerce companies.

Table 4. A sample of usability issues of the websites identified by heuristic evaluation.

Page Type	Markafoni	Trendyol	Limango
Landing Page (Login)	General design of the page is good. Login panel is at the left side of the screen with basic parameters. Other general control and information buttons are on the bottom-bar.	General design of the page is good. Login panel is at the center of the screen with basic parameters. Other general control and information buttons are on the bottom-bar.	General design of the page is good. Login panel is at the center-left side of the screen with basic parameters. Other general control and information buttons are on bottom-bar.
	All necessary buttons and functions are provided on the screen.	All necessary buttons and functions are provided on the screen.	All necessary buttons and functions are provided on the screen except 'e-posta´ (e-mail) and 'şifre´ (password) headings.
	When the user enters the website, cursor is placed in the first data entry.	When the user enters the website, cursor is not placed in first data entry which causes wasted time.	When the user enters the website, cursor is not placed in first data entry which causes wasted time.

Table 4 (cont´d). A sample of usability issues of the websites identified by heuristic evaluation.

Page T.	Markafoni	Trendyol	Limango
Home Page	When one clicks on basket, one can see products in a pop-up screen.	When one clicks on basket, one can see products in a New URL, and it causes wasted time.	When one clicks on basket, one can see products in a pop-up screen.
	For help, there is a 'destek´ (support) button on top-right corner.	There is no ´help´ button on top menu; many users waste time to find it.	There is no ´help´ button on top menu; many users waste time to find it.
	There is no ´search box´ on the screen. When a user is not able to find necessary function/information on the screen, there should be an simple search box on the top screen.	There is no ´search box´ on the screen. When a user is not able to find necessary function/information on the screen, there should be an simple search box on the top screen.	There is no ´search box´ on the screen. When a user is not able to find necessary function/information on the screen, there should be an simple search box on the top screen.
Brand Page	On the ´brand page´ one can only look at a product with a URL change. No pop-up screen. This causes waste of time of users.	On the ´brand page´ one can only look at a product with a URL change. No pop-up screen. This causes waste of time of users.	On the ´brand page´ one can easily look at a product as a pop-screen and contiue to shopping. It avoids spending too much time on each product page.
	There are two important missing options; 'bedene göre sırala' (arrange according to body size) and 'tükenenleri gizle' (hide the out of stock items). Without these options, the users have to search all products including out of stock/size.	All necessary navigational options are provided.	All necessary navigational options are provided.
	There is no ´search box´ on the screen. When a user is not able to find necessary function/information on the screen, there should be an simple search box on the top screen.	There is no ´search box´ on the screen. When a user is not able to find necessary function/information on the screen, there should be an simple search box on the top screen.	There is no ´search box´ on the screen. When a user is not able to find necessary function/information on the screen, there should be an simple search box on the top screen.
Product Page	There are two ways to undo or escape --clicking ´home page´ and 'back' button (upper-left corner).	Only way to undo or escape is by clicking ´home page´.	There are two ways to undo or escape --clicking ´home page´ and 'back' button (upper-right corner).
	There is no size table. Sometimes users order wrong size of a product which causes waste of time and money.	There is no size table. Sometimes users order wrong size of a product which causes waste of time and money.	Pop-outs size table. It protects users to order wrong size of a product.
	When a user clicks 'add to basket' button without choosing size, size warning is seen on the screen as pop-up.	When the user clicks 'add to basket' button without choosing the size, there is a warning on the screen. However, it is hard to see .	When user clicks 'add to basket' button without choosing the size, there is an effective warning on the screen.
	All necessary information about the products is displayed clearly.	Some of the product pages do not include enough information about the products.	All necessary information about the products is displayed clearly.

4. 2. User Testing

4. 2. 1. Descriptive Statistics of Performance Variables

Task completion time, task completion success rate (or failure or abandon) and number of page views were recorded for each task and participant. Table 5 depicts these results for the web design of three e-commerce companies; in addition to the participants´ subjective ratings of perceived easiness of the tasks. The participants had greater than 90% success rate for all six tasks for all three companies. Success rate of Markafoni is slightly better than Trendyol and Trendyol is better than Limango. Task completion times, on the other hand varied dramatically for some tasks. For example for Task 1, the average task completion time was more than 40% higher for Trendyol compared to Markafoni.

4. 2. 2. Factor Effects on Task Completion Times

Effects of classification factors *gender*, *daily internet use frequency*, and *web design of company* on the task completion times were determined by analysis of variance (ANOVA). For the purpose Tasks 1, 2 and 3 were combined as browsing task ($Task_B$) since they were related to browsing the website. ANOVA results indicated significant ´*web design*´ (company) effect on ´task completion time´ for $Task_4$ (checkout) ($p<0.01$) and $Task_6$ (after sales) ($p<0.05$) but not on $Task_B$ and Task 5. *Gender* and *internet use frequency* did not have significant effect on task completion times of all the tasks.

Table 5. Overall performance results of the user testing.

Website	Task no.	Success (%)	Fail (%)	Abandon (%)	Avg. time spent (sec)	No.of page views	Ease of task
Markafoni	1	100	0	0	61.5	4.1	1.5
	2	100	0	0	12	0.75	2
	3	100	0	0	83.6	6.1	0.9
	4	100	0	0	54.7	2.5	1.4
	5	100	0	0	16	2	2.1
	6	91.7	8.3	0	33.7	3.1	1.4
Trendyol	1	91.7	8.3	0	107	4.9	1
	2	100	0	0	10.4	1.3	2.3
	3	100	0	0	77.7	4	1.3
	4	100	0	0	58.4	2.6	1.1
	5	100	0	0	15.6	1.6	2.2
	6	91.7	0	8.3	54.1	2.9	0.2
Limango	1	100	0	0	88.2	5.8	0.9
	2	100	0	0	11.3	1.1	2.3
	3	91.7	0	8.3	100	5.6	0.6
	4	91.7	0	8.3	91.5	4.7	-0.1
	5	100	0	0	20	1.6	1.3
	6	91.7	8.3	0	30.9	3	0.5

Tukey´s multiple comparison tests indicated that $Task_4$ had taken significantly less time on Markafoni and Trendyol websites compared to the Limango website ($p<0.05$). There was no difference between Markafoni and Trendyol websites. $Task_6$ had taken significantly longer time for Trendyol website compared to the Markafoni and Limango websites ($p<0.05$). There was no difference between Markafoni and Limango websites.

Although statistical analysis results did not indicate significant difference, the difference of means of $Task_B$ completion times between three websites were about 39 s (Trendyol (-) Markafoni), 43 s (Limango (-) Markafoni) and (Limango (-) Trendyol) was about only 4 s.

4. 2. 3. User Reviews and Feedbacks

Because the user testing was performed in-person without any service provider or software; as the investigators, we were able to monitor users´ moves on the websites and reactions as they moved along the tasks. This provided much needed insight to understand how user interacts with the websites. Most of the problems related to the websites has been realized and understood by this process. Common complaints related to all three websites were the lack of search option on the websites, lack of visibility of the system status and the font sizes in brand and product pages.

5. Recommendations

To improve the design of the websites so that there is a better user experience, some suggestions were made (Table 6).

Table 6. Recommendations for the redesign of the websites.

Page Type	Markafoni	Trendyol	Limango
Landing Page	Keep the existing design.	Only difference between existing and new design is that 'become a member' button has changed. Now, the user should become a member in the new URL with more information.	Landing page's 'Login Panel' design is completely changed. Because in the existing design, some headings were missing and not easily seen by the user. New design is similar of Markafoni.
Home Page	Keep the existing design but add a search box on the top-bar.	At the top-bar, the button places of 'davet et' (invite) and 'çıkış' (exit) are switched. A 'yardım' (help) button and a search box are added to the top-bar.	The button places of ´limango blog', 'limango download' and 'davet et' (invite) are moved from top-bar to the bottom-bar. Also A 'yardım' (help) button and a search box are added to the top-bar.
Brand Page	All product navigation options should be changed similar to Trendyol's navigation bar. Also add a search box.	Change the top-bar as the home page and add a search box.	All product navigation options should be changed similar to Trendyol's navigation bar. Also add a search box.
Product Page	Breadcrumbs are added under the navigation-bar, also a size-table link is added to right of the 'lütfen beden seçiniz' (please select a size).	Add a ´size table´ link to the right of the 'unit number button'.	Keep the existing design.

6. Conclusions

A usability evaluation of the websites of the three e-commerce companies operating in Turkey (Markafoni, Trendyol and Limango) was performed by both heuristic and user testing methods. The results indicated a number of usability issues regarding the design of the websites by both methods. The heuristic evaluation showed a number of basic design mistakes with all three e-commerce websites.

User testing results indicated high success rate for all three websites. Best success rate was obtained on Markafoni website followed by Trendyol. However, there were significant task completion time differences among the three websites for some tasks. These results were independent from *gender* and *internet use frequency*. Overall, Markafoni website appeared better than other two and Trendyol website was better than Limango in terms of user experience.

Table 6 (cont´d). Recommendations for the redesign of the websites.

Page Type	Markafoni	Trendyol	Limango
Check-out Page	Keep the existing design.	Keep the existing design.	´kasaönü fırsatları' (check-out opportunities) is deleted from page. Because it was too noisy for the user's eyes. Most of the users do not attempt to shop there; it is just a waste of time.
Account Page	Keep the existing design.	´kampanya ve e-bülten abonelikleri' (special offer and e-bulletin subscription) and 'ilgilendiğim kategoriler' (categories I am interested in) lists are changed from top-down sort to left-right sort. By this way, the user will not scroll down too much to see other options.	Keep the existing design.
Help Page	Keep the existing design but add a search box.	Keep the existing design but add a search box.	Keep the existing design but add a search box. In addition, some of the unnecessary help questions should also be eliminated or should be merged with each other.

Recommendations were provided to improve the user experience related design mistakes of the websites for all three companies.

In conclusion, all three company websites require major redesign efforts that utilize the user experience principles in order to improve customer experience, thus resulting in more business.

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