

Factors Influencing Online Shop Layout Preferences

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Abstract. The usability research on web pages layout preferences of online shops consumers has been continued since 2008 on a sample of over 1,000 Polish students. This gives a possibility to observe changes in preferences, both over time as well as across the respondents' buying experience. Preferred locations of selected interface objects specific for an online shop, like a shopping cart, product image and search button were analyzed. The research showed that the main differentiating factor of preferences is the users' experience. Concurrently, the layout patterns preferred by more experienced participants were consistent with standards defined as the most frequently used placement of the objects on existing online shop web pages.

Keywords: Web usability · GUI · E-commerce · Users' preferences

1 Introduction

An online shop layout is one of the user navigation components, as it refers to the appearance and design of a website and influences the total effort of making a purchase. Reducing the search costs for a purchase, interpreted mainly as time needed to do it successfully, is a key motivation for consumers to shop online [15]. A web page design is partially responsible for the online shop ease of use, which is one of the five¹ factors affecting consumer attitude toward a retail web site [5]. Moreover, if the layout of a web site, including online shops, matches up users' expectations, it elevates the web site effectiveness by increasing orientation and reducing the time to complete a task. This was shown a.o. in the eyetracking study by Roth et al. [17].

The main purpose of the research which continues since 2008 is to investigate layout preferences of online buyers. Such analysis was inspired by Bernard's publications [1–3] about placement of web page typical elements like a title, internal and external links, the ad banner and the internal search field. A similar research, which de facto redid aforementioned studies, was done by Markum and Hall [11] and Shaikh and Lenz [18]. However, contrary to Bernard's research, in the presented study preferred locations of all the investigated items are shown on the same screen side by side, not separately, thus creating some sort of a mock-up of desired page layout. A similar approach was also applied by Roth et al. who investigated the mental model of internet

¹ The other four factors are: information, entertainment, trust, and currency.

users in different web sites [16]. Due to similarity of some aspects of that research to the presented one, especially in the part related to online shops, there was the possibility of comparing results. However, it is worth to note that in the abovementioned research, in contradiction to the presented one, participants have no influence on the size of area covered by specific items.

The idea of our research was also to check the influence of some factors described in the model of the Unified Theory of Acceptance and Use of Technology (UTAUT), as proposed by Venkatesh et al. [20]. The model has four core determinants of intention and usage (performance expectancy, effort expectancy, social influence, and facilitating conditions) and four moderators of key relationships (gender, age, experience, and voluntariness of use).

In the research, the layout preferences of ten objects characteristic for online shops were analyzed as follows:

- *account log in*,
- *search*,
- *homepage link*,
- *terms of service*,
- *similar products* (i.e. other products in a given category),
- *category index* (i.e. a list of all categories),
- *shopping cart*,
- *add to shopping cart*,
- *product description*,
- *product image*.

2 Tools Description

Two purpose-built applications were used as research software for data collecting and interpreting separately. Both are intended to work over the Internet, which gives the possibility to store data in a database file and to evaluate it remotely afterwards.

2.1 Data Collecting Software

For data collecting, microSzu software was applied. The main idea of the software is to let the respondent show his or her layout preferences by placing a set of virtual cards labelled with typical online shop items like the *search* button or the *add to shopping cart* button. The program uses a metaphor of a board that mimics an area of a webpage and cards representing items under examination. The virtual cards can be placed on any of the fields of such vertically and horizontally partitioned board. In the study a partitioning grid with eight columns and six rows was used. The user can decide on the layout of objects as well as on the area covered by a single object.

MicroSzu application runs within a web browser. A subject places the cards at different fields of the board, which are preferred by him/her as the location for a given object. Technically, the investigation is done as a two-step process using two separate screens to interact with. The first one is the metric questionnaire to fulfill. The second

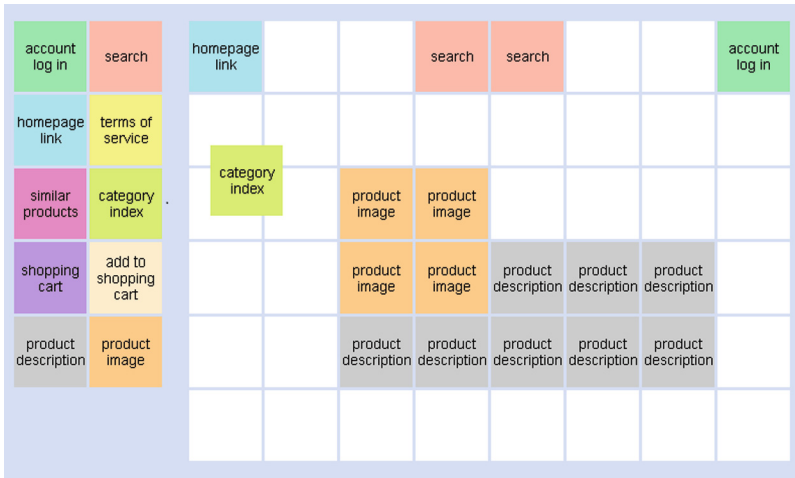


Fig. 1. The main interface of the microSzu application showing an example of the layout preferences filling-up process.

screen, presented after the questionnaire, displays the cards container situated on the left, and the board divided into fields where the cards are placed at, which occupies the main area of the screen. Additionally, some instructions are presented on the right side. The size of all visible elements automatically fits browser's window size in which application was started. For placing items the "pick & paint" method is used, which means that the subject works like in a simple paint application. A card chosen from the container with a mouse click becomes a default "painting" tool, so the user can quickly fill up a portion of the board with a specified card by repeated mouse clicks. At any moment, any card can be deleted from the board by a mouse click over an already occupied location. This fulfilling mode was chosen over the (also implemented) classical "drag & drop" method because our preliminary investigation [9] had shown it as a faster one for the majority of subjects. An example of the filling up process is illustrated on Fig. 1.

The software can be used for collecting data offline and online. A file format chosen to store data collected by the application is a variant of CSV (Comma Separated Values) standard.

2.2 Data Analyzing Software

For data analysis another application, called microVis, is used. This software was designed specifically for selecting, filtering, statistical analyzing and visualization of data from the microSzu software. More technical details about the software can be found in the paper by Kuliński et al. [10]. MicroVis enables to filter data collected by microSzu according to specified rules. Numerous filters can be applied in the same time, which allows for compound analysis. Due to the data specificity a statistical analysis is conducted on the non-parametric basis only. For comparisons of relatively

huge data structures (like the way of fulfilling each of 48 fields of the board) the Pearson's Chi-square test was implemented. The significance of heterogeneity is checked for each of investigated items separately by comparison of two selected data subsets. Because every cell of the observed contingency table need to be adequately populated (see [7, 8]), an algorithm for rebinning data in cells and resizing the table is used. In consequence, even data subsets that differ strongly in population sizes (that is, these with unequal numbers of preference records assigned after filtering) still can be statistically compared, but at the expense of lowering the test's sensitivity.

The visualization of microSzu data is generated as placement density tables for each investigated web page object separately. Each table cell includes information about the selection frequency of the field for placing an item. Moreover, for better clarity of presented data, the scale of grays is used, giving a readable tip about more and less frequently chosen areas.

3 Results

The results include preferences collected by the microSzu software in the years of 2008, 2009, 2010, 2011, and 2015. The total number of subjects and analyzed records was 1016. The participants were adult Polish students of Wrocław University of Technology and Academy of Fine Arts in Wrocław. However the applied software gives the possibility to conduct data gathering over the Internet, the investigation was provided in a computer laboratory in order to keep the procedure under control. All the results were checked for consistency of the objects' selected locations. If the position of at least one object was marked in two different places (not physically connected on the board), all results from the subject were omitted. After this reduction of abnormalities, total number of 796 results was taken into account. Also, some subjects indicated single fields as preferred locations for objects, not showing the approximate size of an object, but only its rough location; still, these results were taken into account during analysis. Finally, records from 499 women and 297 men were investigated.

3.1 Experience and Voluntariness of Use

The experience moderator, as proposed in the UTAUT model, was measured by frequency of online shopping on the semantic scale ("never" – means no experience, "once a year at most", "several times a year", "once a month", and "several times a month or more"). The voluntariness of use was measured binary: if the participant have ever done online shopping, he or she showed the voluntariness of use. The impact of experience was checked between each of the groups, however, the most significant differences were found between subjects with no online buying experience and experienced participants, who buy online several times a year or more often. The significance of heterogeneity ($p < 0.05$) was confirmed for 7 of 10 investigated objects, as shown in Table 1.

Some interesting results can be observed by graphical comparisons. For the *homepage link* object, preferences of experienced subjects are more condensed and

Table 1. Chi-square test results for differences between subjects with no online buying experience (n = 303) and those who buy at least several times a year (n = 286).

| Object name | p-value | Computed χ^2 | d.f. |
|-----------------------------|---|-------------------|------|
| <i>account log in</i> | 0.020084 | 22.61 | 11 |
| <i>homepage link</i> | 0.008454 | 31.12 | 15 |
| <i>Search</i> | 0.255101 | 22.61 | 19 |
| <i>add to shopping cart</i> | 0.036949 | 40.24 | 26 |
| <i>category index</i> | 0.009830 | 40.35 | 22 |
| <i>product image</i> | 0.989973 | 16.37 | 32 |
| <i>shopping cart</i> | 5.4×10^{-10} | 81.14 | 18 |
| <i>similar products</i> | 0.000492 | 60.79 | 29 |
| <i>product description</i> | 0.651464 | 28.36 | 32 |
| <i>terms of service</i> | 0.000037 | 84.10 | 39 |



Fig. 2. The *homepage link* object: layout preferences of subjects with no online buying experience (left) and subjects who buy at least several times a year (right).

concentrated in the upper left corner (Fig. 2). This is probably caused by a higher awareness of a homepage link typical position among experienced online shop buyers. This effect shows that people prefer rather a typical, standard position of items instead of searching across the computer screen.

A similar observation can be made for other investigated items, like the *shopping cart* object (Fig. 3). Experienced buyers' preferences are more concentrated and there are considerably less unusual locations for the object, like lower left part of the screen, compared to participants with no experience. This result is very similar to the location of a shopping cart area presented in the research done by Roth et al., in which almost all participants were experienced online shoppers [16]. However, due to its specificity, this object is not so strictly connected with one particular screen region, like it was in case of the *homepage link* (see Fig. 2), therefore, even the preferences of experienced participants still show significantly more dispersion than those depicted previously. This remains consistent with the outcomes of other layout expectations investigations [3, 16, 18], where the homepage link area was most centralized among all the web interface objects under examination.

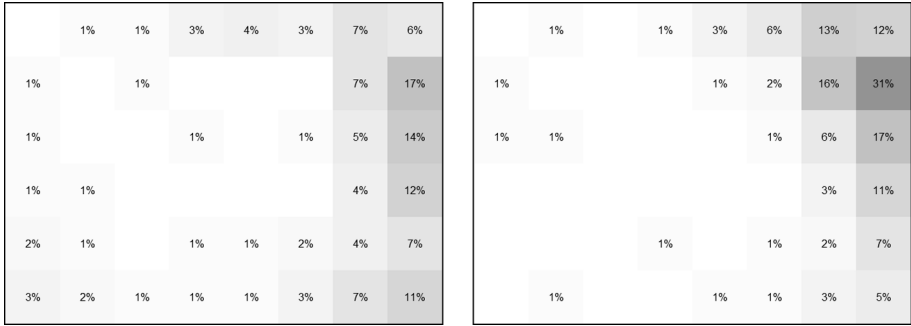


Fig. 3. The *shopping cart* object: layout preferences of subjects with no online buying experience (left) and subjects who buy at least several times a year (right).

Table 2. Chi-square test results for differences between females (n = 499) and males (n = 297)

| Object name | p-value | Computed χ^2 | d.f. |
|-----------------------------|-----------------|-------------------|------|
| <i>account log in</i> | 0.050168 | 22.35 | 13 |
| <i>homepage link</i> | 0.005876 | 33.75 | 16 |
| <i>Search</i> | 0.006637 | 39.02 | 20 |
| <i>add to shopping cart</i> | 0.821719 | 22.84 | 30 |
| <i>category index</i> | 0.000900 | 54.41 | 26 |
| <i>product image</i> | 0.021956 | 51.32 | 33 |
| <i>shopping cart</i> | 0.500708 | 22.33 | 23 |
| <i>similar products</i> | 0.171446 | 42.79 | 35 |
| <i>product description</i> | 0.706447 | 29.10 | 34 |
| <i>terms of service</i> | 0.000719 | 77.40 | 42 |

3.2 Gender

Generally, gender related dichotomies in layout preferences are similar to aforementioned differences related to experience (Table 2). Significant differences were stated for objects: *homepage link* ($p = 0.006$), *search* ($p = 0.007$), *category index* ($p = 0.0009$), *product image* ($p = 0.02$), and *terms of service* ($p = 0.0007$). Thus, the analysis of preferences related to gender and experience combined factors was conducted. Some more statistically significant differences were stated only between little experienced men and women (online shopping once a year or more seldom). For other groups of men and women with an equal level of experience, statistically significant differences were found at most for only two objects from the tested pool, and in all these cases the minimum significance level was above 0,01. This supports the hypothesis that gender dichotomies are caused probably by different frequency distributions of buying from online stores. Much higher proportion of subjects with no experience among women than among men was stated (47.2 % vs. 22.6 %, respectively). Additionally, men were the larger of the two gender groups of online buyers that buy several times a year or more often. That means that gender generally may have

a little influence on layout preferences, however, in the aforesaid group of subjects with small experience, differentiations were statistically significant for the *search* ($p = 0.01$), *category index* ($p = 0.006$), *similar products* ($p = 0.001$), and *terms of service* object ($p = 0.03$).

3.3 Age

It was proved that age does not constitute a factor that differentiates preferences. Some small but statistically significant discrepancies were found by comparison of 19 and 23 year-old participants (the *account log in* object; $p = 0.01$ and *terms of service* object; $p = 0.01$). A visual interpretation confirms the little age impact on online shops layout characteristics, but this effect can be caused by our sample homogeneity, as mentioned below.

3.4 Changes Over Time

The coverage and frequency of online shopping is still growing, which can be observed in the research results as well. In the year of 2008 over 1/3 of our participants (37.3 %) was not shopping online. In 2015 this group was 12.7 % only, but some of the respondents pointed auction portals as the most often visited online shop, though it was inconsistent with the instructions given to them during the survey. Nevertheless, the rising tendency in our study is even higher than observed among Polish internet users, which was 43 % of non-shopping users in 2008 and 24 % in 2014, according to the CBOS (Public Opinion Research Center) research [4].

There were no statistically significant differences stated neither between 2008 and 2009, nor between 2010 and 2011. Between 2009 and 2010, only one significant difference was found (for the *search* object; $p = 0.048$). However, comparisons of data from 2010 or 2011 to 2015 show as much as five significant discrepancies (the *search*, *add to shopping cart*, *shopping cart*, *category index*, and *similar products* objects). These results are shown in Tables 3 and 4, respectively, although it is worth to note that due to a significantly smaller sample for 2015 (45 cases after removing abnormalities), the sensitivity of the applied test is lower. To confirm the results, the sample should be extended to 150–200 subjects in 2015.

For the *add to shopping cart* object (Fig. 4) it can be observed that preferences in 2015 are less spread than earlier ones and concentrated in the middle part of the screen's right side. Also, visual representations of its preferred locations for 2008, 2009 and 2010 are very similar to these presented for 2011.

An interesting result is visible for the *category index* object (Fig. 5). In 2011 and earlier this item was preferred to be close to the three screen borders, with the most distinctive concentration on the left side. In 2015 focusing on the left border is still noticeable, but the concentration is the highest in the area closer to the upper border. Additionally, the top area was pointed out by some participants. This result is very similar to the location of navigation area presented by Roth et al. [16]. Probably this tendency is caused by a rising popularity of vertical menus over time, but this observation needs further analysis.

Table 3. Chi-square test results for differences between preferences gathered in the year of 2010 (n = 157) and in 2015 (n = 45).

| Object name | p-value | Computed χ^2 | d.f. |
|-----------------------------|-----------------|-------------------|------|
| <i>account log in</i> | 0.061734 | 7.34 | 3 |
| <i>homepage link</i> | 0.217864 | 5.76 | 4 |
| <i>Search</i> | 0.000728 | 28.70 | 9 |
| <i>add to shopping cart</i> | 0.000066 | 34.76 | 9 |
| <i>category index</i> | 0.001302 | 23.67 | 7 |
| <i>product image</i> | 0.995815 | 4.99 | 16 |
| <i>shopping cart</i> | 0.037000 | 11.84 | 5 |
| <i>similar products</i> | 0.001347 | 35.26 | 14 |
| <i>product description</i> | 0.928768 | 7.15 | 14 |
| <i>terms of service</i> | 0.397065 | 14.73 | 14 |

Table 4. Chi-square test results for differences between preferences gathered in the year of 2011 (n = 116) and in 2015 (n = 45).

| Object name | p-value | Computed χ^2 | d.f. |
|-----------------------------|-----------------|-------------------|------|
| <i>account log in</i> | 0.534417 | 2.19 | 3 |
| <i>homepage link</i> | 0.458950 | 3.63 | 4 |
| <i>Search</i> | 0.016325 | 20.27 | 9 |
| <i>add to shopping cart</i> | 0.033666 | 18.13 | 9 |
| <i>category index</i> | 0.024587 | 16.06 | 7 |
| <i>product image</i> | 0.991723 | 5.62 | 16 |
| <i>shopping cart</i> | 0.039891 | 11.65 | 5 |
| <i>similar products</i> | 0.035677 | 24.89 | 14 |
| <i>product description</i> | 0.745513 | 10.23 | 14 |
| <i>terms of service</i> | 0.050803 | 23.63 | 14 |

4 Summary

According to the UTAUT model, each of the four moderators (experience, voluntariness of use, gender, age) was investigated. Venkatesh et al. stated that the influence of performance expectancy on behavioral intention is moderated by gender and age, and such the effect is stronger for younger users [20]. This observation is not supported by presented research. In our study age related discrepancies were not observed, maybe due to the age homogeneity of subjects. The differences of layout preferences found between men and women are probably caused by the experience levels variation and not by gender itself. In the investigation done by Roth et al. the expectations of web objects location were also similar for men and women, even though men declared higher frequency of internet usage and online shopping [16].

Elliot and Speck showed the negative and significant interaction between the experience of users and ease of use in the process of online shop evaluation [5].

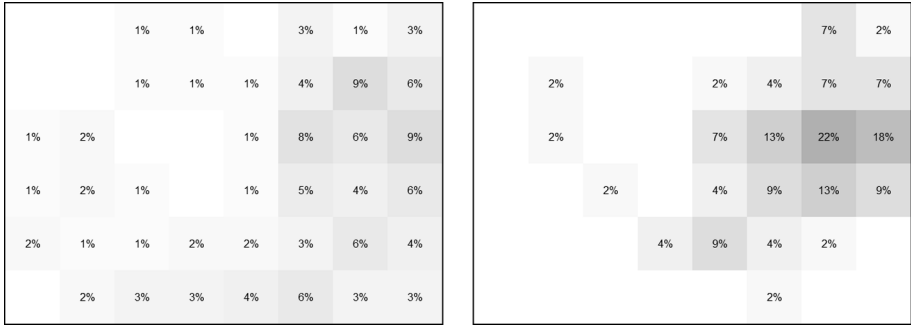


Fig. 4. The *add to shopping cart* object: layout preferences of subjects surveyed in the year of 2011 (left) and in 2015 (right).

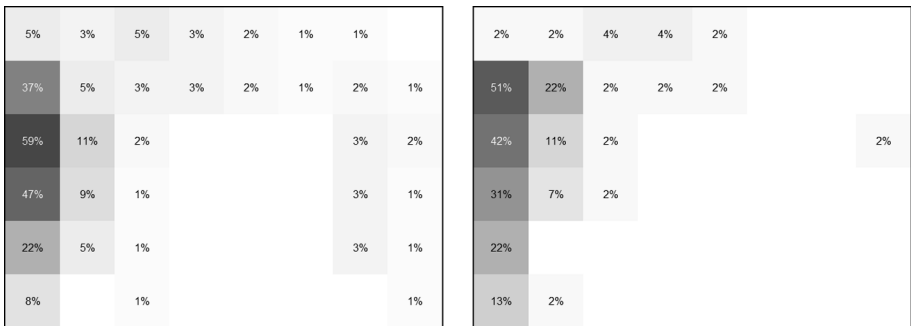


Fig. 5. The *category index* object: layout preferences of subjects surveyed in the year of 2011 (left) and in 2015 (right).

This means that for inexperienced customers, higher levels of the ease of use factor are indeed related to a more favorable evaluation of retail web sites, but the same is not necessarily guaranteed in case of experienced ones. Probably more experienced users had an occasion to interact with different online shop interfaces and therefore they feel more confident. Actually, the preferences of the most experienced users are less spread and dispersed than non-experienced ones, as our results show. Furthermore, the experienced users’ preferences are more consistent with common web standards, examples of which are visible on Figs. 2 and 3.

The changes over time also showed some relation between preferences and standards (see Fig. 5). However, in this case the impact of rising experience of participants can be observed as a concentration of preferences in the most often used parts of the screen for each specific object. Similar observations were made in other follow-up surveys [9, 19]. It can be stated that, among the investigated moderators, the experience of user is a decisive one.

4.1 Research Limitations

The strong limitation was narrowing the participants' age. As they all were students, the age discrepancy was not large. Probably this is the reason for the lack of preferences differences in various age groups. Elder participants should be involved in a further research.

Since the participants were Polish students only, another limitation is homogeneity of the sample itself. To buffer the homogeneity impact, participants were recruited from two different universities and a few different faculties. An international research by Nielsen showed no differences related to usability among students on three continents, including Europe [12]. Therefore, it can be assumed that Polish students represent typical online behavior in terms of usability.

4.2 Conclusions

User performance and user preference are intuitively supposed to be positively correlated, for example Nielsen and Levy showed a strong correlation between the average task performance and an average subjective users' satisfaction [13]. However, this relation cannot be so unambiguous, which was stated e.g. by Lee and Koubek [14]. While the results of study conducted by Wu and colleagues [21] indicate that an online shop layout design may have a positive influence on a purchase intention by impacting both an emotional arousal and attitude toward the website, at the same time the layout alone proves to be not as significant as the atmosphere created with use of colors, which in turn influences customer's moods and emotions.

The other interpretation of layout preferences is given by Roth et al. [16]. According to their model, users' preferences show mental model of online shop pattern, which are the most expected by users. Nevertheless, both approaches emphasize the significant role of web site layout in total usability of web site, defined in the ISO 9241 standard as the effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments [6]. The layout of an online shop can influence all the main characteristics of usability by enabling a user to fulfill tasks (effectiveness), while minimizing resources needed, especially time (efficiency).

Additionally, the web site layout pattern consistent with user preferences increases the user's satisfaction. Though, according to the presented research, for increasing the overall usability of online shop it is crucial to use the layout which is in accordance with standards and users' expectations and preferences.

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