The Effect of Contrasting Selected Graphical Elements of a Web Page on Information Retrieval Time

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Abstract. *As online presence plays an increasingly important role in corporate success, the high usability of a company's website becomes one of its most valuable assets. The time required to reach the needed information, which plays a key role among the many factors that influence a website's usability, depends to a significant degree on the site's design. The perception of the visual aspects of design is in turn influenced by various so-called "visual means". This term encompasses a range of methods, procedures or techniques of using elements of graphical design to achieve the desired effect, which should be applied according not only to the informational content of the site, but also to the designer's overall vision, i.e. the graphical layout of the site. Therefore, it can be said that a usable website design is largely dependent on the site's composition, understood as maintaining the appropriate relations between its form and content. One of methods for increasing the visibility of a given graphical element is highlighting its distinctness, difference from other elements. This method is called contrasting. This article presents the methodology and a discussion of the results of original research into the impact of contrasting chosen text elements on the home page of a website on the time needed by a user to reach the information "privileged" by such a procedure.*
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1. Introduction

Jakob Nielsen, one of the leading experts on web design and usability, empha-
sises the fact that, with the increasing competitiveness of the Internet and the grow-
ing demands and expectations of the users, website usability is crucial to corporate
success [1]. It is quite clear that the usability of a website is directly correlated to
its understandability for the end user [2]. An underestimated factor, however, is
the correlation between the various visual elements (colours, shapes, photographs,
pictures, typeface, etc.) filling the graphical layout and the structuring of the con-
tent (e.g. hierarchisation – the ordering of the content according to its importance
– or grouping – classification according to similarities and differences) associated
with those elements. A home page of a website plays a crucial role in the explo-
ration of the site's contents by the user. The uniqueness of the page's design and
the conciseness of the contents are often decisive for the user's interest in the offer
of the company, cultural institution, etc. As evaluating webpages based on their
aesthetic aspects entails a risk of subjectivity, the time needed by the user to reach
the desired information (link) can be a more reliable criterion for assessing the
effectiveness of the design. This article presents time measurements for different
contrast levels of a priority text elements on the home page of a website.

2. Related Work

Understanding how people look for information and how the graphical design
of a webpage influences this process is an important scientific and commercial
problem, with a large body of experimental results published. In their 1998 work,
J. P. Benway and D. M. Lane study human perception of advertisement banners [3].
In the following years, their research has been furthered by M. Bayles, M. Burke,
A. Hornof, E. Nilsen, and N. Gorman [4, 5, 6]. Published in the same year, the
article by P. Faraday and A. Sutcliffe shows the importance of the relation between
the content and the visual aspect for the graphical design [7]. T. Halverson and A.
Hornof present experimental results on how text colour affects visual search [8].
B. Pan, H. A. Hembrooke, G. K. Gay, L. A. Granka, M. K. Feusner, J. K. Newman
explore user strategies for browsing websites [9]. A. De Angeli, A. Sutcliffe, J.
Hartmann have evaluated two websites with the same content but different inter-
face styles (traditional menu-based and interactive metaphors) [10]. E. Cutrell and
Z. Guan investigate the influence of snippet length on the navigational and infor-

mational efficiency of web pages [11]. Y. Yesilada, C. Jay, R. Stevens, S. Harper analyse how users perceive and utilise visual elements on web pages and what role they play in task solving [12]. A.W. Rivadeneira, D.M. Gruen, M.J. Muller, D.R. Millen and S. Bateman, C. Gutwin, M. Nacenta present results of their research into tag clouds and how visual properties of text capture the attention of users [13, 14].

3. Experiment

The main aim of the experiment was to investigate whether modifying selected graphical elements will make priority information on the home page of a website easier and quicker to locate by the users. The page was modified by differentiating the presentation of text elements containing the information. The first measurement was conducted on the original page; in the second one, the quantity and layout of the priority text was modified; finally, in the third one, the text was moved to another section of the page with a simplified layout and modified font size and colour.

3.1. Method

Data. The basis for the analysis was the corporate website of LSI Software SA. During this study, it was assumed that the priority information is the Enterprise Resource Planning (ERP) software for the hotel, retail chain and food industries offered by the company. For the purposes of the experiment two alternative versions of the home page were created on previously prepared copies of the page.

Participants. The participants of the experiment were 42 volunteer students (mean age: 21.5 years) of the Computer Science Department, 10 female and 32 male. All participants had over 2 years experience with the Internet and were familiar with the Mozilla Firefox browser, version 3.x.

Measures. The experiment measured the time to complete the task, i.e. click a link containing the priority information. All priority links were located on the home page of the website. It was conducted using a dedicated database-based software package "Nawigo", designed to prepare a test environment for tracking user behaviour on a chosen website. The application, based on the PHP 5 programming

language and a MySQL database, identifies clicks and stores data as navigation paths. An important feature of the application is that it supports three types of websites:

- hosted on the same server as the application,

- hosted on an external server,

- hosted in a mixed environment, where the whole site is located on an external server and the home page is replaced by one hosted on the same server as the application (this set-up was used in the experiment).

As access to the test environment was granted only to the participants, the experiment did not influence the functioning of the actual website, as visible to regular users. During the experiment the application recorded the place (link) and time for each click with a precision of 1s. Measurements started as soon as the all components of the page had finished loading and ended when the first link was clicked. The experiment employed the Mozilla Firefox 3.x browser and a 21' LCD display.

Experimental design.   The experiment consisted of three parts, each part involving a group of 14 participants. The first group consisted of 4 female and 10 male participants (mean age: 21,1); the second one, of 3 women and 11 men (mean age: 21.6), and the third group - of 3 women and 11 men (mean age: 21,8). All three groups were instructed to complete the same task, described as "On the home page of the site, find links to software solutions offered by LSI Software and click one of them". Before proceeding to the main task, all participants completed a pilot task and were advised about the nature of the experiment. In the first part, the participants used the original version of the home page. Priority information, i.e. links to the software, were located at the bottom of the page and emphasised by pictographs and a bold font of the category names (Fig. 1).

In the second part, the participants were required to complete the task using a modified version of the home page. The page was modified by removing all additional information from the individual sections of the links to product categories, while leaving the links themselves unchanged at the bottom of the page. The bold font of the links was preserved. Additionally, the size of the pictographs was slightly decreased to reduce the line spacing to a more appropriate value without impairing readability (Fig. 2).

In the third part of the experiment, the participants used a version of the page with further modifications. In this variant, the modifications consisted of a change
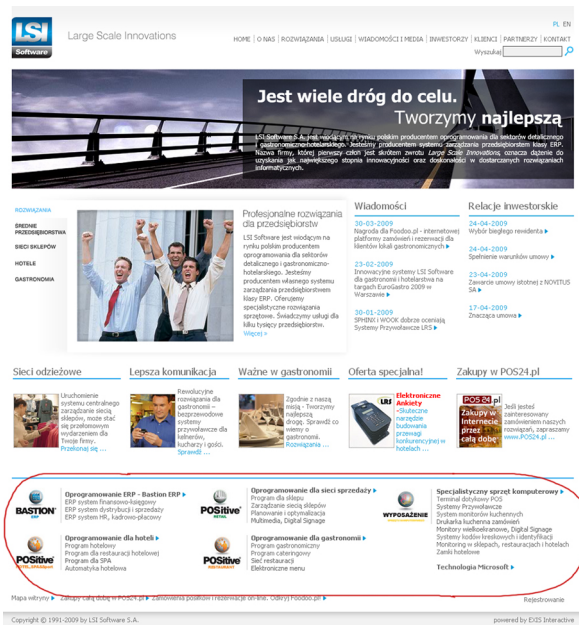
Figure 1. The original home page of the LSI Software SA website (the priority section is marked by a line)

of location of the links, as well as the layout, size and colour (12.5 pt, white font) of the texts. Links containing priority information were moved to the page header. Since the header already contained text, the original content was replaced with the priority information. An additional requirement in this part was to preserve the overall visual impact of the original header (Fig. 3).

3.2. Results

In the first part of the experiment, the original version of the home page was used. The measured mean time for completing the task was 23.6 s (standard error of the mean $SEM = 4.0$ s).

In the second part, the participants used a modified version of the home page with priority information emphasised by eliminating additional content of with secondary informational value in order to increase the contrast for noticing priority information (Fig. 2). Additionally, the visual impact of the text was increased
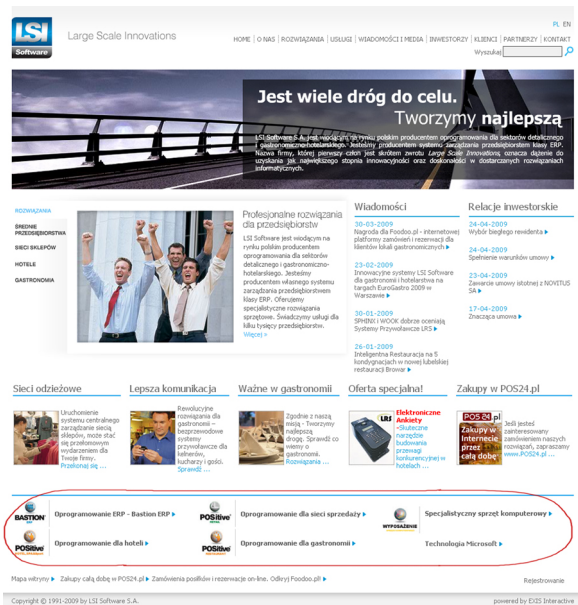
Figure 2. The modified home page of LSI Software SA (the area marked by a line designates the text modified in the experiment)
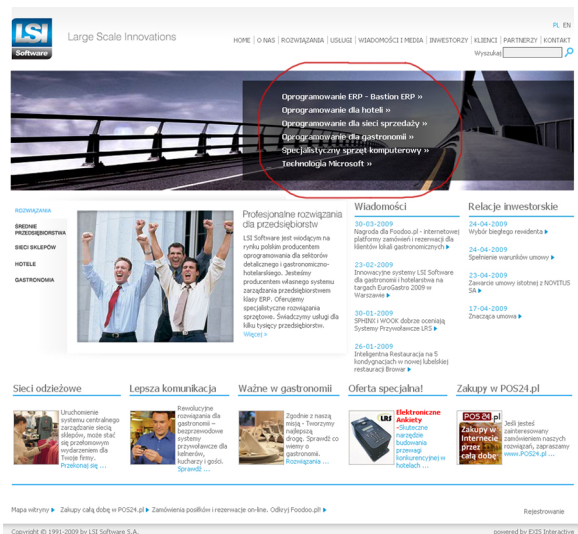

Figure 3. The modified version of the LSI Software SA home page (a line marks the area of the second modification, i.e. the adaptation of the location and presentation of the text containing the priority information)

through a wider line spacing and decreasing the size of the pictographs. The measured mean time for completing the task was 15.3 s (SEM = 1.6 s), 8.3 s shorter than for the first group. This indicates that adopting this design strategy resulted in a significantly shorter time of locating the information.

The version of the page used in the third part of the experiment included a larger number of modifications. Most importantly, the priority texts (links) were highlighted by bright colours and placed on the dark header of the page with a modified layout and the accompanying pictographs eliminated. In general, this version of the page adopted a wider range of methods for increasing contrast between the links and the rest of the page (Fig. 3). The measured mean time for completing the task was 12.1 s (SEM = 1.9 s), slightly (3.2 s) shorter than in the previous version (Fig. 4).
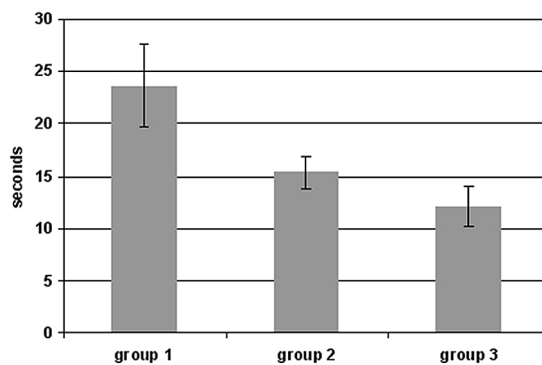

Figure 4. Mean time for completing the task for the 3 groups

4. Conclusions

The aim of the experiment, i.e. increasing the impact of priority information, was achieved by emplying the following methods of contrasting: the change of location of the text (moving it to the page header); making the text lighter through a wider line spacing; eliminating unnecessary graphical elements (pictographs); changing the layout of the text to one column and left alignment; changing the font and background colour (white text on a navy blue header).

The results of the experiment show that increasing the contrast of selected graphical elements increases the prominence of priority information on a web page, shortening the time needed to reach it. This is especially noticeable if comparing the mean time for completing the task for groups 1 and 3, almost twice as long for the former one. Moreover, the results prove that graphical modifications are effective up to a quantitative and qualitative margin, as evidenced by comparing the results for groups 2 and 3, where the recorded difference was only less significant.

In the light of the presented results, we are confident that further research in the area is most appropriate.

Acknowledgments

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