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Eye-tracking Analysis of the Ergonomics of an Internet-based Educational Portal in the Acceptance Testing Process

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Abstract

In the article I will present the concept of using eye-tracking to examine the ergonomics of operating an Internet educational portal in the acceptance testing process. In the test performed, the results were obtained in nine sections characteristic of the defined AOI[1] vs. REC. Selected data has been presented as an example of the results obtained from a complete study showing how users browse the content of the primary conclusion is the way of arranging information on the home page. Permanent arrangement of information takes the form of a non-editable menu. This is the most popular solution found, because it allows for permanent unity of content and easy search. 1. Coherence is located in the context of logical substantive integration. 2. Communication is measured by measuring average time viewed, fixations and number of revisits to defined areas.

Keywords: eye-tracking, optimisation, ergonomics, effectiveness, content, testing

Introduction

The main feature of the new media is implementation of high-speed Internet (5G) and the relationship between technology (machine) and the user. The machine with the software is necessary to create the content, the main task of which is to reach the recipient with the information. An important element is coincidence of the quality of the message and its effectiveness (understanding, intuitive use, quick access to data). A huge amount of data, information and content are created on the Internet all the time, including in the form of websites (por-

[1] Areas of Interest (AOI) – areas defined and marked in an image.

tals). It is necessary to verify the quality of the created messages. This task is performed by UX or UI designers[2] (Mościchowska, Rogoś-Turek, 2015). Currently, using the eye-tracking technique is helpful in performing such tasks. The technique of tracking human eye movements provides objective data and is a convenient and recognised tool for optimising media messages (Bednarik, Tukiainen, 2006).

The idea of eye-tracking

The main reason why the eye-tracking technique is used in scientific research is the coincidence between eye movements and cognitive processes. This means that the viewer's eyes are drawn to the elements and symbols that are intriguing, attractive or incomprehensible (Rakoczi, 2020). Eye-tracking is used, for example, as a technique of diagnosing and optimising functionality of websites, analysing user behaviour on the net and usability of a wide range of applications and domains (Duchowski, 2006). The use of eye-tracking has become a technique complementary to traditional methods of assessing usability. This is facilitated by the precision/resolution/of an eye-tracker's operation plus the reliability and objectivity of the obtained data which is used to understand the cognitive process related to visual data processing (Kirenko, Wawer, 2015). Eye--tracking is a special type of test because it can be treated as both a qualitative and quantitative study. Due to the physiological nature of the test, which is based on measuring eye positions and movements, we obtain representative quantitative data. The correlations that we will get depend on how we can process and analyse it.

Material and sample description

The material examined was Multimedialny Portal Doradztwa Zawodowego (*Multimedia Portal for Career Counselling*) https://prototypmpdz.host13.deployflex.com/ (20.02.2020). The examined site is currently being expanded and new content is published every day. This is why descriptions and statistics reflect the state and functionality from the day the test was performed. The research sample included students. Respondents were chosen randomly, but within a selected group. The age of the respondents was a conscious choice and ranged from 19 to 23. It was assumed that students have computer skills; moreover, that they have experience in browsing and searching for information on the Inter-

[2] UX designers design websites or digital products in such a way that their use is intuitive and easy, and that they meet the needs of their users. UI designer concentrates on preparing the final interface designs.

net, and their age is the product for the target group. Such a selection of the sample works in favour of the research material, because users who are less skilled at browsing websites may need more time to find and reach the necessary information.

Study assumptions and analysis parameters

The assumption of acceptance testing was to check how users navigate within the Portal structure. In order to obtain a more complete insight into the mechanism of using the Portal during the test, the parameters for AOI[3] vs. REC were defined in the following sections:

1. frequency of eye fixations in AOI,
2. time viewed for AOI,
3. time to first view at AOI,
4. time viewed in% for AOI,
5. number of revisits to AOI,
6. views at AOI by individual participants (REC ...)

In addition, statistical averages were calculated for:

1. time viewed for AOI,
2. number of fixations,
3. number of revisits to AOI.

Due to the article length, I have presented only the exemplary sets of obtained data. In the complete analysis of the obtained results, the above parameters are presented in the form of over 100 drawings, tables and diagrams. The eye-tracking software provides 60 parameters, generated as quantitative data characterising the nature of the graphical testing technique.

Home page (selected example)

There are 7 AOI assumed on the home page (*TSI: Twój System Informacji), O kształceniu zawodowym i doradztwie w Polsce, Wyszukiwarka, Belka startowa, MPDZ, Belka górna, Belka dolna).*

The obtained data was visualised in the form of Heat Maps (Picture 1) showing the explored areas as well as the intensity and activity of users within the website structure. This is complemented with the results providing average

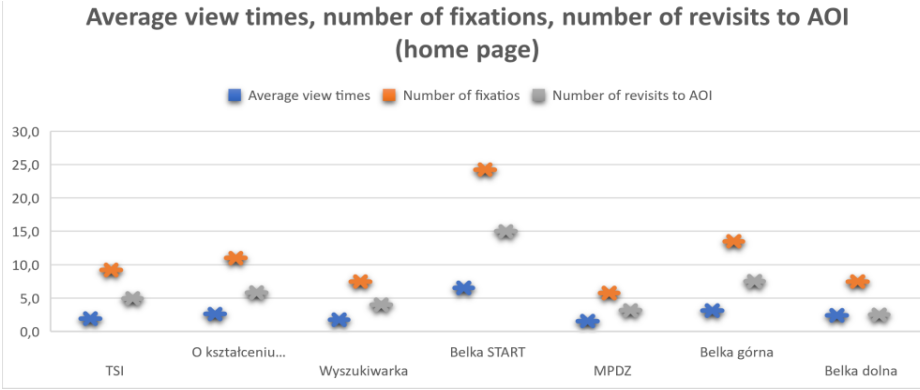
[3] Areas of Interest (AOI) marked in the picture that was subject to the eye-tracking test. They are used to determine the tendency to view and the degree of drawing attention by a given area.

values for: dwell time for defined AOI, number of fixations in AOI, number of revisits to AOI.

Picture 1. Home page of the MPDZ portal. An example of a heat map generated as average values for viewing time at the site during 10 seconds of the test

Table 1. Average view times, number of fixations, number of revisits to AOI (home page)

AOI	Average time viewed for AOI /sec./	Average number of fixations in AOI /frequency/	Average number of revisits to AOI /frequency/
TSI	1.9	9.2	4.9
O kształceniu Zawodowym i Doradztwie w Polsce	2.6	11.0	5.8
Wyszukiwarka	1.8	7.5	4.0
Belka START	6.5	24.3	15.0
MPDZ	1.5	5.8	3.2
Belka górna	3.1	13.5	7.5
Belka dolna	2.4	7.5	2.5



Graph 1. Average view times, number of fixations, number of revisits to AOI (home page)

An important element of the analysis is tracking the behaviour of individual users (REC …). Data available as graphic visualisations, tables, diagrams. It is possible to obtain results for individual users in many different aspects. The examples are:

Table 2. REC data versus AOI (TSI). Home page

AOI Name	User Name	User Gender	User Age	Time to 1st View (sec)	Time Viewed (sec)	Time Viewed (%)	Fixations	Revisits
TSI	REC 2	F	21	12.0	2.1	4.4	9	5
TSI	REC 3	F	20	2.6	2.1	4.3	8	3
TSI	REC 4	M	20	2.8	1.4	3.0	6	5
TSI	REC 5	M	22	3.8	1.0	2.0	5	3
TSI	REC 6	F	21	1.0	2.4	4.9	13	9
TSI	REC 7	M	20	4.5	0.7	1.3	4	3
TSI	REC 8	F	19	1.0	1.9	3.9	9	3
TSI	REC 9	F	21	11.5	0.3	0.5	2	2
TSI	REC 10	M	21	1.3	1.2	2.4	6	7
TSI	REC 11	F	19	1.2	2.3	4.7	12	4
TSI	REC 12	M	22	17.3	2.8	5.7	7	2
TSI	REC 13	F	20	1.0	3.9	8.0	14	5
TSI	REC 14	F	22	14.3	2.4	5.0	14	8
TSI	REC 15	M	21	3.3	3.3	6.8	15	9
TSI	REC 16	M	21	20.7	1.5	3.0	8	5
TSI	REC 17	M	20	17.1	1.3	2.7	5	0
TSI	REC 1	F	21	1.3	2.2	4.6	12	4
TSI	REC 18	M	22	2.4	2.8	5.8	15	4
TSI	REC 19	F	22	1.8	1.4	2.8	10	7
TSI	REC 20	M	23	1.6	1.6	3.2	10	6

Table 3. REC data versus AOI (Wyszukiwarka). Home page

AOI Name	User Name	User Gender	User Age	Time to 1st View (sec)	Time Viewed (sec)	Time Viewed (%)	Fixations	Revisits
Wyszukiwarka	REC 2	F	21	17.0	0.6	1.2	4	2
Wyszukiwarka	REC 3	F	20	5.7	1.2	2.4	6	3
Wyszukiwarka	REC 4	M	20	1.0	2.4	4.9	9	6
Wyszukiwarka	REC 5	M	22	1.0	2.5	5.1	14	10
Wyszukiwarka	REC 6	F	21	5.7	0.5	1.1	2	5
Wyszukiwarka	REC 7	M	20	7.6	2.4	5.0	10	1
Wyszukiwarka	REC 8	F	19	15.8	2.3	4.8	8	2
Wyszukiwarka	REC 9	F	21	11.8	0.6	1.2	3	2
Wyszukiwarka	REC 10	M	21	10.0	9.9	4.3	5	4
Wyszukiwarka	REC 11	F	19	20.4	1.3	2.8	6	2
Wyszukiwarka	REC 12	M	22	18.5	2.3	4.8	10	4
Wyszukiwarka	REC 13	F	20	9.0	3.2	6.6	9	2
Wyszukiwarka	REC 14	F	22	19.3	1.5	3.2	8	3
Wyszukiwarka	REC 15	M	21	9.1	1.5	3.1	4	1
Wyszukiwarka	REC 16	M	21	20.8	1.4	2.9	7	5
Wyszukiwarka	REC 17	M	20	4.4	3.5	7.2	8	3
Wyszukiwarka	REC 1	F	21	5.8	0.7	1.5	7	6
Wyszukiwarka	REC 18	M	22	2.4	1.3	2.8	8	5
Wyszukiwarka	REC 19	F	22	13.2	1.4	2.8	10	8
Wyszukiwarka	REC 20	M	23	7.2	2.7	5.5	9	6

Table 4. REC data versus AOI (Belka START). Home page

AOI Name	User Name	User Gender	User Age	Time to 1st View (sec)	Time Viewed (sec)	Time Viewed (%)	Fixa-tions	Revisits
Belka START	REC 2	F	21	1.2	9.9	20.4	32	12
Belka START	REC 3	F	20	1.0	3.2	6.6	16	8
Belka START	REC 4	M	20	14.1	7.6	15.8	23	15
Belka START	REC 5	M	22	5.4	4.8	9.8	19	9
Belka START	REC 6	F	21	11.1	2.3	4.8	11	13
Belka START	REC 7	M	20	4.1	7.5	15.6	29	21
Belka START	REC 8	F	19	5.4	7.8	16.0	21	11
Belka START	REC 9	F	21	1.0	8.2	16.8	30	16
Belka START	REC 10	M	21	3.8	5.2	10.6	23	21
Belka START	REC 11	F	19	1.9	9.4	19.5	30	20
Belka START	REC 12	M	22	1.2	10.9	22.5	36	24
Belka START	REC 13	F	20	17.6	2.5	5.1	12	14
Belka START	REC 14	F	22	1.1	5.8	12.0	18	13
Belka START	REC 15	M	21	1.0	3.9	8.1	18	12
Belka START	REC 16	M	21	1.5	7.7	15.8	29	16
Belka START	REC 17	M	20	10.5	4.3	8.9	14	10
Belka START	REC 1	F	21	6.9	6.8	14.0	31	13
Belka START	REC 18	M	22	6.7	5.3	10.9	21	13
Belka START	REC 19	F	22	2.2	10.3	21.3	38	21
Belka START	REC 20	M	23	4.3	7.4	15.3	34	18

The exemplary data sets may be premises to make an attempt and answer the following questions: how do users use the proposed structure? Do the recorded user movements meet the project assumptions? Does the structure require reorganisation and modernisation? Does the proposed solution minimise the time needed to reach information? Moreover, the possibility to obtain results from an individual user helps optimise the structure for the defined group of product recipients, but at the same time provides an insight into how users from outside the target group deal with the site. The answers to such questions and to many others concerning the ergonomics of operation can be sought with the use of the eye-tracking technique.

Conclusions

The primary conclusion is the way of arranging information on the home page. The portal has been designed in the form of thematic blocks arranged in a permanent, coherent and communicative manner. Permanent arrangement of information takes the form of a non-editable menu (what is modified is the information added and updated by designers). This is the most popular solution found, because it allows for permanent unity of content and easy search.

1. Coherence is located in the context of logical substantive integration.
2. Communication is measured by measuring average time viewed, fixations and number of revisits to defined areas.

The above factors allow for qualifying the proposed structure of the Portal as a good and well-thought-out communication solution. This minimises the time of orienting a user to reaching interesting information. These measures are certainly a value ordering the organisation of the image space, which works in favour of such a solution – an information project.

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