Performance of Standard and Customized Search Interfaces

E.Natsheh

Dep. of Informatics Engineering, College of Engineering, AMA International University, Bahrain

dr_natsheh@hotmail.com

Abstract—**The research conducts a performance comparison between standard search interfaces available in modern search engines with a customized search interface that allows the user to change the way the information is presented on the screen. The tested hypothesis is that customized search interface results in a decrease in total search time and increase (or the same amount) of successful searches. Customizable options included font, background, help, tool tips, highlights, preview text and Boolean operators. Based on the performed study customized interfaces allowed users to increase the speed of obtaining correct search results by 10.2%. The benefit comes with a cost of time that users spend to configure the interface. Further research is recommended to both test the results on wider audiences, and test additional customization options.**

Keywords—personalized search; cognitive search strategies; search interface; assisted search; implicit feedback; interactive retrieval

I. INTRODUCTION

MODERN search engines provide many tools to improve the search productivity, speed and convenience [1]. Still, many people are struggling with the online information finding, and are refrained from using advanced search methods. The proposed customized search interface is an attempt to improve the search experience through allowing the user to adjust the search interface to better suit their needs. Fast information retrieval from the Web is arguably one of the most prominent achievements of the modern age; therefore, any measurable improvement of this process will positively affect lives of millions of people.

The aim of this research is to examine and compare the efficiency of standard search interface versus a customizable search interface. The efficiency will be assessed in terms of the amount of search inquiries successfully answered and total time spent searching. The hypothesis is that the users will spend less total search time using a search interface that was previously customized by them in an optimal way and obtain the same or higher amount of correct results.

To customize the search interface the users will be presented with options to easily configure the following elements: typeface (font family), font size, font color and style, background color, turn on and off simple help, advanced help, tool tips, highlighting of key words, add elements of Boolean logic search (operators such as AND, OR, etc.). The users will also choose how much of preview text will be shown on the results page: from no preview text – only titles of pages – to a full paragraph of text up to a hundred words. This way the user decides whether the search results should be brief and compact, or lengthy and detailed – depending on the user's general preference or specific search need.

The research will not look into such entities as prior training, search algorithms, automated personalization of search results, user query correctness or information visualization. The delays in the testing caused by the Internet latency are disregarded. The basic search training provided equally to all of the participants before

Article history: Manuscript received 28 April 2019; received in revised form 13 July 2019; Accepted 22 July 2019.

the test will compensate the possible differences in knowledge of information retrieval methods. Both standard and customized search interfaces were designed and programmed to include equal search functionality.

II. LITERATURE REVIEW

Although a large body of research on the personalization of search results is available, there is not so much literature on the customizable search interfaces. To help establish the difference between personalization and customization, Amy Shade's definitions are provided as follows. Personalization is done automatically by the system itself based on the information available about the user (as an individual or as a part of a user group). Such information may include user's location, search history, purchase history, behaviour patterns, etc. Customization, on the contrary, is done manually by the user with the purpose of meeting "their specific needs by configuring layout, content, or system functionality" [2].

Customization is a known technique in Web development that developers apply to improve the usability and convenience of the interface. It is argued that providing customizable interfaces may be critical for "catering to individual tastes and preferences" of each user [3]. A customizable interface is the one that "lets users make their own selections about what they want to see or set preferences for how information is organized or displayed" [2].

One of the main problems with conventional personalized search engine is that it generally works as a black box. There is little option for better formulation of the query so advanced users feel lack of control over the search process [4]. On the other hand, the customized search interface proposed in this study attempts to solve this issue by providing the users with more control and transparency. With options to adjust the interface and add tools such as help and Boolean operators the search process is more open and straightforward as it promotes user involvement.

Dumais, etc. studied different search interfaces to find one that helps minimize the search time. In that study results grouped in categories turned out to be faster in terms of information retrieval speed than other options. Example given, mean search time for results sorted in categories was 25.5 seconds faster than mean search time for results shown as a regular list. They also discovered that summaries of the search results help users find the needed information faster [5] [6] [7]. Based on this the option to configure the length of the summary was added to the customizable search interface.

Ahn, etc. proposed an entity-based user interface NameSieve. The system was designed to be used in a professional setting by intelligence analysts to support their exploratory searches. The idea behind a novelty interface was, among other innovations, to show a cloud of entities side-by-side with the search results. Results of the study included an increase in productivity and relevance of retrieved documents [4] [8].

Olson and Chi investigated the idea of coupling traditional browsing with searching to improve information retrieval [9]. This was achieved by highlighting the links on the Web page based on the relevance to the search keywords using the ScentTrails approach. The results were promising, since the study resulted in an increase of search speed. This approach basically introduces weighting to the search results and might be interesting to investigate further.

It is important to note that many ways were discovered to improve the speed of information retrieval through increasing the complexity of search interfaces. The studies have shown that only users with advanced knowledge of those presented with special training were able to reap the benefits of complicated search options (such as Boolean logic and fuzzy logic) [10] [11]. Users without prior training or extensive knowledge of search techniques will usually be unable to increase the speed of search with help of advanced search tools. In other words, the user's ability to formulate a correct search query for the given task is the upper limit of their search speed.

Over the years, filtering based on either explicit or implicit (or both) feedback has been covered in many studies. In [12] researches

describe how both implicit and explicit feedback could be utilized simultaneously for the best utilization of available data with the aim of personalized internet information ranking. Their proposed algorithm was based on a combination of the Expected Reciprocal Rank evaluation metric with SVD++ algorithm and resulted in a significant increase in personalized ranking algorithm performance.

Patent [13] involves many browsing behaviour metrics utilized in search results ranking, including mouse movement (speed, direction and consistency), delay of the user response, and even movement of the user captured by the camera. Some of these parameters could be adopted for the current research.

Good user interface should require little or nonadditional training, so the users can get most of the advantages without spending time learning the interface beforehand. Following that idea, customizable interfaces could maximize the search speed for all the user types: from the beginner level to search professionals. They would allow the less proficient untrained users to use the search system in a simple (and less efficient) way, while the advanced users could configure the interface so it would cater to their abilities and knowledge. In a customizable interface, beginner users could ignore in-depth functionality and keep the interface simple and useful. At the same time, advanced users have the opportunity to use all the available powerful search functionality.

III. METHODOLOGY

For the purposes of this study, two programs were developed in Java using Google API, where one included standard search interface, and another – customizable search interface. All the functionality was kept the same for both programs, with the only difference in that the customizable search interface had additional options that allowed the user to configure the font, background, turn on and off help, tool tips, highlights and add fields that represented certain Boolean operators. Also, another simple program was written as a Google Chrome browser add-on as a tool to measure the total search time: the users pressed Start in the beginning of the test to start the timer, and likewise pressed Stop as soon as they replied to the last task in the list.

Participating in the research were 100 undergraduate university students. They were randomly distributed into two equal groups of 50 people each, where the first one (Group I) was assigned to use a standard search interface and the second one (Group II) was assigned to use a customizable search interface. During the test, all of the participants were given the same list of 20 questions to search answers for. The questions were unambiguous, and only one answer could be deemed correct. Table I show the structure of our experiment methodology.

TABLE I. EXPERIMENT METHODOLOGY

Interface Type	**Structure of the experiment**		
	Group ID	***Number of Participants***	***Search Target***
Standard interface	Group I	50 Participants	20 questions
Personalized interface	Group II	50 Participants	20 questions

In order to hasten our process of calculating the time taken for each participant and the accurateness of their search results, we wrote a simple programme that recorded the starting and ending searching time of each participant, calculates the correctness of each search and then automatically generates a report for our reference. Table II shows example of automatically generated report from the experiment.

There was a small message window at the lower left of the Internet browser screen. This window was consisting of buttons for the user to start and stop the experiment, as shown in Fig. 1. Once the participants clicked on the 'Yes' button, the time counter stopped, and they were not allowed to continue searching anymore.

All the participants received a basic training on efficient search and on personalization of the search interface, which lasted for 30 minutes with additional 15 minutes spent on a question and answer session. Then, Group II was given 10 minutes to configure their interface as they see fit. Before the start of the test, both Group I and

Group II received sample search queries and were asked to spend 30 minutes using their respective search interfaces to become comfortable working with them (their results were not measured). The test Members of the Group II were allowed (and encouraged) to introduce further changes into the customized interface settings during the test whenever they feel the need to (the time count was not stopped).

TABLE II. TEMPLATE OF AUTOMATICALLY

Participant	Performance Measures	
	Total search time (minutes)	*Correct searches*
1		
. . .		
50		
Total		
Average search time		
Average correct searches		

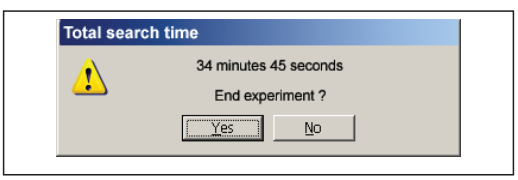

Fig. 1. Comparison between standard and customized search interfaces

After a participant was done with the tasks, they were invited to another room and asked to share their opinions and comments on the search interface and the search process. Their answers were recorded, and conclusions applied to the discussion section.

IV. RESULTS

The study was performed with all the participants at once. The total time of the actual study was 2 hours, where 30 minutes were spent on the training, 15 minutes on the question and answer session, and 10 minutes on the configuration of the customizable interface. After a 5-minute break, the next 40 minutes was when the test was conducted, and the last 20 minutes were spent to interview the last participants and conclude the test.

The fastest total search time was 12 minutes and 22 seconds, the slowest – 37 minutes and 2 seconds. The mean total search time for Group I was 26 minutes and 19 seconds, for Group II – 23 minutes 38 seconds. The mean amount of correctly answered questions was 14 for Group I and 16 for Group II. Fifteen people from Group I and nineteen from Group II answered correctly to all 20 queries. Fig. 2 summarizes these results.

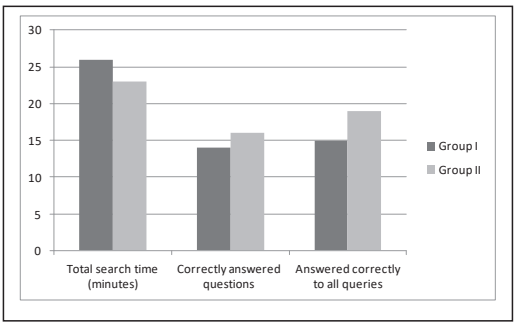

Fig. 2. Comparison between standard and customized search interfaces

The mean total search time is 2 minutes and 41 seconds faster for the Group II, and the mean amount of correctly answered questions is larger by two for the Group II. Given the average total search time of Group I was 1579 seconds, the recorded 161 seconds difference for Group II represents a 10.2% decrease in total search time. 161 seconds decrease in total search time means that for 20 questions, in average, the users in Group II spent 8.05 seconds less time searching. The null hypothesis is formulated as "the users spend the same or more total search time or obtain less correct results using a customized search interface". The null hypothesis is rejected with a significance level $\alpha = 0.05$ ($p=0.0065$). Therefore, the conclusion is that the users spend significantly less total search time and obtain the same or more correct results using a customized search interface.

V. DISCUSSION

The quality of the test was satisfactory: a significant part of the test participants was able to find correct answers to all of the questions. The only concern in that regard might be that the tasks might have been somewhat too simple.

As all the participants were from the same university and had similar exposure to computer science and information retrieval, it might affect the results. It is recommended to extend the study to include various user groups.

Feedback received from the participants after the end of the test included many suggestions to add more options for customization and update the user interface design to a better-looking modern one. Otherwise, the participants' comments were mostly positive about the project and the performance of the study.

VI. CONCLUSION

The results obtained in the performance of the study suggest that the prototype with the customized search interface is superior in terms of search performance as compared to the standard search interface, at least for some users. The recorded increase in average searching speed was 10.2 percent, or 8.05 seconds per question. However, the cost of customization is additional time spent on the customization and getting acquainted with all the customizable options. Overall, providing better control over the search interface and the search process allows the user to work more efficiently. The research has shown that personalized search interface indeed may be used as a tool to provide such control. Nonetheless, the main takeaway from the study is that more research on broader user groups is required to determine clearly the effects of search interface customization. A new research may also include additional customization options such as categories, weighting, entity clouds or other options.

ACKNOWLEDGMENT

The author would like to express his appreciation to College of Engineering at AMA International University Bahrain for supporting this research.

REFERENCES

[1] C. Smith, S. Rieh, "Knowledge-Context in Search Systems: Toward Information-Literate Actions", Proceedings of the 2019 Conference on Human Information Interaction and Retrieval, pp. 55-62, 2019.

[2] A. Schade, "Customization vs. Personalization in the User Experience", Nielsen Norman Group, 2016. Available: https://www.nngroup.com/articles/customization-personalization/ [Accessed: April 25, 2019]

[3] S. R. Subramanya, B.K. Yi, "User interfaces for mobile content", *Computer, 39*(4), 85-87, 2006.

[4] J. W. Ahn, P. Brusilovsky, J. Grady, D. He, R. Florian, "Semantic annotation based exploratory search for information analysts", *Information processing & management, 46*(4), pp. 383-402, 2010.

[5] S. Dumais, E. Cutrell, H. Chen, "Bringing order to the web: Optimizing search by showing results in context", *Proceedings of CHI'01, Human Factors in Computing Systems*, April 2001, pp. 277-283, 2001.

[6] S. Dumais, E. Cutrell, H. Chen, "Classified displays of web search results", Inited presentation at *ASIS&T SIG/CR Classification Research Workshop*, Nov 12, 2000, pp.87-90, 2000.

[7] E. Agichtein, E. Brill, S. Dumais, "Improving Web Search Ranking by Incorporatig User Behaviour Information", *ACM SIGIR Forum, 52*(2), pp. 11-18, 2018.

[8] J. W. Ahn, P. Brusilovsky, S. Han, "Personalized search: Reconsidering the value of open user models", Proceedings of the 20th International Conference on Intelligent User Interfaces, 2015.

[9] C. Olston, E.H.Chi, "ScentTrails: Integrating Browsing and Searching on the Web", Proceedings of the ACM Transactions on Computer-Human Interaction. pp.177-197, 2003.

[10] H. Topi, W. Lucas, "Mix and Match: Combining Terms and Operators for Successful Web Searchers", Information Processing and Management, 41(4), pp. 801-817, 2005.

[11] E. Natsheh, "Personalized Web Documents Filtering by Analyzing User Browsing Behaviors", International Journal of Information Studies (IJIS), 5(2), pp. 57-65, 2013.

[12] G. Li, Q. Chen, "Exploiting explicit and implicit feedback for personalized ranking", Mathematical Problems in Engineering, vol. 2016, pp. 1-11, 2016.

[13] N. Gur, U.S. Patent No. 9,449,093, Washington, DC: U.S. Patent and Trademark Office, 2016.