Cultural Differences on Seeking Information: An Eye Tracking Study

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Abstract
The main goal of this research is to investigate how people with different cultural background differ in their interaction style and visual behavior on search engine results pages (SERP), more specifically between groups from the Middle Eastern region vs. Western Europe. We conducted a controlled eye-tracking experiment to explore and evaluate the visual behavior of Arabs and Spaniard users when scanning through the first page of the search results in Google. Big differences can be observed in the 4 aspects studied: U.A.E. participants stayed on the SERPs for longer, they read more results and they read each snippet in a more complete way than Spaniards. In Spain, people tended to scan the SERP, reading less text on each snippet, and choose a result among the first top ranked ones without hardly seeing those in bottom positions.

Author Keywords
search engines; cultural differences; eye tracking; visual behavior; user experience

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

Introduction

The Internet has revolutionized the way people live, work, study, shop, communicate and do business. Search engines are considered the main entrance gate to the web because it allows to find pages of interest according to queries. Nevertheless, little attention has been given on the presentation of the search results pages based on cultural differences. Nowadays, the interface looks the same for all users regardless of their location. but previous research [6] argue that there is a correlation between culturally determined thinking patterns and search behavior.

"Culture is the collective programming of the mind that distinguishes the member of one group or category of people from others" [5], it dictates the behavior of people in many aspects including the type of interface design preferred in websites [7] . Due to the globalization and emergence of the Web 2.0, measuring and interpreting *culture* is imperative in several areas such as search engines that are attempting to provide more personalized search results.

Several cultural studies have been performed on the visitor's visual behavior with search engines using eye tracking machines. An eye tracking machine is a device used to monitor and record users visual search pattern on a screen content and approved as a reliable tool used extensively in several usability studies [8]. The reasons is that eye tracking machines unobtrusively follows a readerséye movements and gives the most likely locations of where a person has looked and stop reading. The equipment allows to plot a *heat map* that highlights the areas where readers looked the most. This information is useful to determine where the data such as text, images and adds should be placed.

The main goal of this research is to investigate how people with different cultural background differ in their interaction style and visual behavior on search engine results pages (SERP), more specifically between groups from the Middle Eastern region vs. Western Europe. We conducted a controlled eye-tracking experiment to explore and evaluate the visual behavior of U.A.E and Spaniard users when scanning through the first page of the search results in Google (including the related commercial ads). We choose SERP interface from Google because it is the search engine with the highest market share in the world [1]. We collect the usersvisual navigation behavior and interaction with search results, this data is both quantitative and qualitative. We are interested to examine if culture influences the behavior of these two groups in the way they evaluate the list of search results to choose a link. We expect to find some differences in reading patterns, number of search results considered, browsing time on SERP until a result is clicked (Dwell time) and success answer ratio of answers. In the future we will also analyze how special elements like ads, multimedia results or rich elements attract visual attention.

The significance of the study is to determine if cultural differences between users demand for local adaption of different way to enlist search results to match users' searching strategy and expectations. The study is aimed to help researchers gain an understanding of how different user groups from two different cultural backgrounds (Spain and U.A.E) read, view and interact with the list of search ranked results and how their visual and clicking behavior relates to cognitive activities for decision making. We are hoping, the findings from this study will help web search engines to display search results appropriately according to the needs and expectations of users with diverse cultural background.

[1] Source from netmarketshare.com

Figure 1: Heat map showing vertical reading patterns of Spaniard participants

Figure 2: Heat map showing horizontal reading patterns of Arab participants

To our knowledge, very few research studies used a comparative approach and explored the impact of cultural factors on user navigation strategies on SERP.

The paper is organized as follows: the first section discusses the research questions, methodology as well as the eye tracking experiment design. The subsequent section presents the preliminary results, data analysis and discussions. The last section contains the conclusion which includes a summary, implications and importance of the study, limitations and suggestions for future research.

Related Work

One of the most influential works on modeling and defining culture comes from Dr. Geert Hofstede.He focused on how countries can be compared and contrasted in terms of only few values [5]. The values to compare cultures are called *cultural dimensions*. These dimensions were proposed as definition and they have a meaning *only* when making comparisons.These dimensions are related to 1) the level of acceptance of unequal distribution of power, 2) individualism and collectivism, 3) masculinity and femininity, 4) the stress involved when dealing with uncertainty, 5) importance of tradition and 6) indulgence vs. restraint.

There is not a clear and unified method to associate empirical data in different scenarios with Hofstede's dimensional cultures. Several methods have been adapted to specific situations. For example, Chau et al. [2] argued that individualism and collectivism are particularly relevant in studying the use of services built around Web 2.0, including OSN. Likewise, Ford et al. [4] discussed how to accommodate one of the five cultural dimensions in user interfaces to increase usability.

On the other hand, recent studies have concluded that Western learners tend to have more analytical cognitive learning style whereas East Asians tend to have more holistic or contextual learning style [9]. Hoffstede cultural model is used in the study to explain the behavioral cognitive and perceptual differences between the two culturally diverse users groups.

In a cross-cultural study conducted by Vuylsteke et al. on consumers information search behavior [11], they found significant differences between Chinese and Western Europeans in their online search behavior with respect to frequency, goal, types of information sought, websites selected as well as users usage patterns. Nevertheless, this study is based on *interviews and questionnaires* that can cause biases on the answers.

Several research studies examined consistency of user expectations for major web and user interface elements (such as navigation tools, hyperlinks and colors, logs, search box and others) placement on websites [3, 10, 12]. Other researchers took this common issue a bit further and compare expectations with different users groups as well. For example, Auinger et al. on his work related to user expectations on the web [1] investigated the validity of four web elements design principles using eye tracking data for European vs. Anglo-American users. The findings from their study suggest there are cultural differences regarding the web elements design.

We are not aware of many unobtrusive tests made on visual search behavior on SERPs, specially not studies involving cross-cultural comparisons between middle easters and europeans.

Methodology

In total, 117 people participated in our test: 60 people in Barcelona (Spain, Western culture) and 57 in Dubai

Figure 3: Spaniard participants read few results

Figure 4: Arab participants read many results

(U.A.E., Eastern culture). From these groups, 63% of participants are women and 80% are between 18 and 40 years old. Tests were run at the respective labs at University Pompeu Fabra in Barcelona and Zayed University in Dubai.

We built 12 SERPS with 3 versions of each: one with ads, other with enriched snippets like images, maps, etc., and other with *no* adds or enriched snippets. We attempted to cover all kind of elements that search engines usually include in SERPs. Our SERPs were divided in 3 general topics with results to queries related to architecture, sports and tourism.

In our test, participants were asked to answer 12 questions (4 by topic). For each query, we first presented the question to participants and its corresponding SERP. We controlled that all participants have the same SERPs for each specific query. Second, participants were instructed to click on the result they thought was the most appropriate for the query. Finally, they were asked to choose an answer to the query from a list of 4 options: a wrong answer, a right answer, *I don't know* and *none of the above*. The answer to the queries could be visualized in the results presented in the SERP.

The eye-tracking equipment used was Tobii 1750 in Spain and Tobii 120 in Dubai. The software Tobii Studio 2.3 was used for the data analysis. The metrics obtained per country so far were the following:

1. *Hetmaps for reading patterns*: heat maps indicates the time that the users spent on each result, and a reading pattern can be obtained from them.
2. *Number of results read by the users*.
3. *Time to Fist Click (TFC)*: indicates the dwell time of the users on the list of results until deciding which result to click.
4. *Success rates*: percentage of right answers

Preliminary Results

The 4 metrics analyzed show interesting differences between both countries:

1. *Reading patterns by country*: while a scanning vertical pattern can be observed in Spain (figure 1), a clear horizontal one is given by U.A.E. participants (figure 2).
2. *Dwell time on SERPs*: Spain users spent much less time on SERPs than U.A.E. participants, who prefer to read more before taking a decision. On average, Spaniards took 39.26 seconds per page and Arabs took 62.99 seconds. We used Mann Whitney to verify that there was actually a statistical difference between the two groups. Figure 6 shows that 50% of participants in Spain took less than 10 seconds per page before choosing an answer in contrast to 20 seconds for the other group.
3. *Number of read results by country*: accordingly to the previous results, Spain participants read less results than U.A.E. users. In particular Spaniards read mostly top ranked results while Arabs consider bottom results as well before the click (figure 3 and 4).
4. *Success rate*: surprisingly, more successful answers can be found in Spain tests (50% right in Spain, 40% in U.A.E) but the percentage of wrong answers is similar (43% wrong in Spain, 39% in U.A.E). The difference is due to the *none of the above* option (Spain, 2% vs. U.A.E. 12%) and *I don't know*

	SPAIN	UAE
Right	50%	40%
Wrong	43%	39%
None	2%	12%
Don't know	3%	9%

Figure 5: Success rate between Spain and U.A.E

option(Spain 3% vs. U.A.E. 9%). This implies that Arab people from our test preferred to chose one of these options (*I don't know* or *none of the above*) more than Spaniards who preferred to risk for a right answer more often. Figure 5 shows the success ratio for U.A.E and Spain.

Discussion and Conclusions

Big differences can be observed in the 4 aspects studied: U.A.E. participants stayed on the SERPs for longer, they read more results and they read each snippet in a more complete way than Spaniards. In Spain, people tended to scan the SERP, reading less text on each snippet, and choose a result among the first top ranked ones without hardly seeing those in bottom positions.

More work will be necessary to determinate the reasons of these differences. So far, we think that they can be attributed to several factors:

1. Cultural aspects:
   (a) Our results seem to be coincident with [9] theories about holistic cognition of Eastern cultures versus the analytic style in Western cultures. They compared East Asian and American, while we observed people from an Arab culture and a Mediterranean one, so Nisbett's work not necessarily can be applied to this study.
   (b) Presence of the moderator intimidated people in Zayed University. According to [5], Arab countries are ranked between the 12-14 place in power distance while Spain occupies ranks place 45-46 (lower power distance). A typical behavior of large power distance countries is the respect to teachers even outside class. We believe that this motivated users from Dubai to spend more time looking for the answer in SERP.
2. Language skills: Spaniards saw SERPs in their native language, while U.A.E. users saw them in English. Although U.A.E. participants had high skills in English and take calsses in English, being non-native speakers could have caused a slower performance and a lack of self-confidence performing the tasks.

For now, we have preliminary results that should be validated and compared with future experiments considering:

- To run an Arabic version of the test in U.A.E. and English test in Spain
- To add more countries from different cultures
- To do a detailed analysis by age, by genre, comparing organic results to ads, comparing different types of results (multimedia, site links, social recommendation, etc)
- To add new questions and new topics
- To allow users to type their own queries and to see the clicked results

This is a first study on how cultural aspects can affect the visual and cognitive behavior on information seeking in search engines. We consider this is an interesting research topic for Human-Computer Interaction community and Information Retrieval.

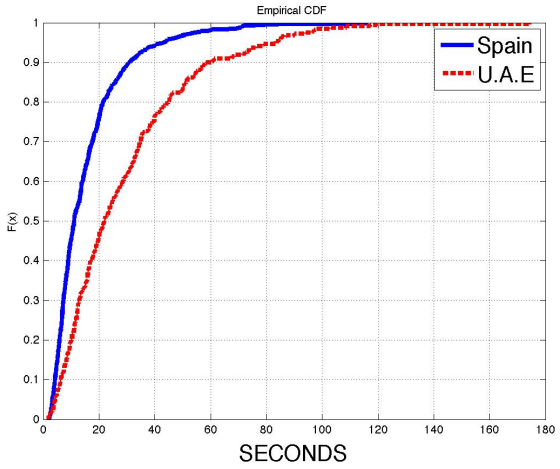

Figure 6: CDF of dwell time on SERPs of participants from U.A.E and Spain

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