Do Ads Matter? An Exploration of Web Search Behavior, Visual Hierarchy, and Search Engine Results Pages

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Abstract

Users tend to ignore advertisements when viewing a web page, however, when searching for a specific product or service, advertisements can be very useful. This exploratory study examines the impact of online advertisements within search results. The findings provide support for the competition for attention theory in that users are looking at advertisements and entries when evaluation SERPs. We also examine web page search behavior and how it can affect user experience. The results show that eye tracking data is valuable for designers, marketers, and usability experts to develop and evaluate web page design.

1. Introduction

People use search engines to find all types of information. Search engines often provide advertisements on top of the page, which according to theory of visual hierarchy are likely to get a great deal of attention. After all, this is how search engines generate revenue. Last year, 54% of Internet users used the Google search engine at least once a day [27]. The Internet has not only become a valuable source of information [11], but it has also become a marketing media for companies. Marketers are using search engine result pages (SERPs) for displaying ads to users, hoping to attract them to their own websites. For search engine companies and companies who tend to use text advertisement in their on-site search result lists, understanding users' search behavior has major implications for improving their user experience design. Further, gaining valuable insights of users' search behavior will aid all companies, who have a web-based presence, in search engine optimization and e-marketing strategy development. Marketers are continually striving to increase their web presence and appeal to consumers. Internet-based advertisements have been on the rise in the last few years. In 2011, Internet advertising revenues reached a total of $31.74 billion, with 69% generating from advertisements in search and web page banners [19]. Despite the 22% increase in revenues from 2010, consumers are still prone to skipping ads, making it imperative for marketers to find new ways of attracting attention for potential clicks.

For this study, we are interested in understanding the impact of advertisements on users' search behavior on search engine result pages (SERPs). While other studies have explored search behavior and concluded that lists are best for browsing search behavior (i.e. [17, 21]), few studies have looked at what would be the impact of ads on this search behavior. Following previous studies we are using Google as an example of list-based SERPs to explore the impact of advertisements in search results and their impact on attention before the first action taken by the user on the page. Following the suggestion that viewing a web page is similar to viewing a magazine [22], users who are purposefully searching for information, tend to focus on the center of the page where the main text will load, before their attention is directed elsewhere on the page [24]. We have chosen to focus on the time period after page loading to the first action (i.e. scrolling or clicking).

2. Theoretical Background

2.1. Web Search Behavior

How a user views a web page has been linked to visual marketing, Internet advertising, web usability, and web design (i.e. [5, 14, 26]). Faraday [15] defined viewing behavior as a series of fixations. Pan et al. [26] examined web page viewing behavior using eye-tracking and 22 different web pages, varying in type, design, and style, concluding that one's viewing behavior is directly impacted by type of page, gender, and page order. In a subsequent study that involved the users' experience with the Google search engine, Pan et al. [25] found that users trust the rank and relevancy of returned search results, therefore leading to a greater intention to click on the first result entry.

Users search in two ways: a goal-directed search, which is typically used for gathering specific or targeted pieces of information, or an exploratory search, less demanding and for a casual search [20]. Hong et al. [17] posited a direct link between information formats and shopping tasks, asserting that browsing is matched to a SERP of list format and searching is matched to a SERP of matrix format.

Other studies have examined viewing behavior on web pages [11, 24], but few have given special attention to the impact of text advertisement on browsing search behavior, where the search results are in a list format [5, 16].

2.2. Visual Hierarchy

Expanding the idea of viewing behavior, Faraday [15] defined visual hierarchy of a page as the order in which information is communicated to a user. Visual attention plays a crucial role in forming viewing behavior [9]. Further, viewing a stimulus is a sequential cognitive activity, and people can only process one visual stimulus at a time, especially those that are in close proximity to one another which tend to compete for a viewer's attention [8]. This is especially true for items that are adjacent to the focal area [1].

Web pages communicate and interact with users through perceptual elements like text, images, video, or font size. In addition to a user's own bias, visual hierarchy plays a major role in page navigation [15]. For example, the visual hierarchy of a page can be manipulated by changing the size of one of the local objects or by changing a static image to one that is dynamic. Items placed at the top of a web page tend to be perceived as more important [15], likewise viewers demonstrate a tendency for processing images before other items [3].

2.3. Competition for Attention

According to the competition for attention theory, competition for attention is not limited to the boundaries of items adjacent to a focal area. Large stimuli that are not close to the focal area can still act as a distraction and compete for a viewer's attention [20]. Following Janiszewski's [20] definition, competition for attention can be expressed numerically, by capturing the size and distance of the competing object to the focal area. He proposes that a non-focal stimuli's demand for attention is estimated by the ratio of the area it occupies and its distance from the focal vision. For example, the square root of its size is used in the calculation to show a

relationship between the demand for attention of the object surrounding the focal point and a user's fixation duration of the target object. Users have a tendency to gaze at a target object that is surrounded by objects with weaker "demand for attention" values for a longer period of time. Studies show that the format of a viewing area, in this case a web page, can play a significant role in a user's performance when searching for information [17]. Based on the competition for attention theory, we expect the ads to take away the attention from the other search entries.

2.4. Banner Blindness

Web users are 'functionally blind' to advertisements on a web page [2, 4]. Banner blindness has also been described as users skipping ads intentionally [14]. Chatterjee [6] posited that users tend to overlook advertisements, particularly those that are in the banner location, and focus more on web results and other webpage enhancements. Despite the mixed opinions around what causes a user to 'act blind' towards an ad, studies (i.e. [5, 18, 23, 29]) continue to confirm similar results, users tend to not look at advertisements on a web page. These advertisements are used to solicit clicks from users and provide sponsored links related to the keywords performed in the search. In their study on banner blindness and text advertising, Owens et al. [23] found users exhibiting "banner blindness" to text advertisements, just like display and banner ads. Although location and type of search is a factor, users ignore ads unless perceived to be useful in completing their search task. We speculate users continue to exhibit this type of behavior because of the over-saturation of advertisements that tend to clutter the tops and sides of the web page.

The theories above provide the foundation for this study. Would the presence of ads affect the attention to the returned search results? Do users spend more time looking at ads than at entries? Our exploratory study considers these research questions. Overall, advertisements have the potential to distract the user by diverting their attention to less useful information, which may lead to a negative user experience. Therefore, we speculate the following:

- Visual hierarchy, competition for attention, and banner blindness are factors that influence a user's web search behavior
- Users will ignore advertisements and focus solely on entry results
- Ads and entries that are adjacent on SERPs will compete for attention since the areas of interest (AOI) are of similar shape and size.

- SERP entries that are higher on the page will be viewed more than those lower on the page.

3. Eye Tracking Experiment

Each subject involved in the study was required to carry out two web-based searches using Google. All queries were made to the actual real-time Google search engine website. Returned search results were not altered in any way, allowing for a pure user-experience environment. Fixation is one of the indicators of viewing behavior, and has been declared as a reliable measure of attention [7, 13]. In this study, we want to explore whether the number of ads generated in Google SERPs affect the amount of attention given to the first result entries after an ad.

Eye tracking data was collected using the Tobii X120 eye tracker, which was connected to a 24-inch monitor with a resolution of 1920 x 1200. The eye tracker had a sample rate of 120Hz. As designed by Tobii and the accompanying software, a series of eye-tracking data was collected, including but not limited to, eye movements and location of gaze on the monitor. Areas of Interest (AOIs) were designated manually, as a way of grouping gaze locations, in order to serve as a means for analyzing the eye-tracking data at the conclusion of data collection.

4.1. Participants and Design

Data, for two different tasks, was collected from a total of 18 participants (13 male, 5 female), using the Tobii eye tracker and software, resulting in a sample of 36 sets of data. The subjects ranged in age from 18 – 24. From the full sample, 7 sets were removed from task 1, and 5 sets were removed from task 2, due to the accuracy or absence of the data being collected. When asked, all participants self-reported as "expert" users of Google as a search engine. All of the participants use Google search engine on a daily or hourly basis. Each participant was assigned to do the same two searching tasks on a regular desktop computer. The order of the searching tasks was assigned randomly.

4.2. Task

For the searching tasks, participants needed to use Google search engine to search certain specific information based on the assigned scenario. The key words were given. In task 1, participants were asked to use the key words "free screen recording software" to find free screen recording software that they would use for their coursework. In task 2, participants were asked to use the key words "best snack in Boston" to find a snack place in Boston that they would like to visit with their friends.

4.3. Measurements

The eye tracker allowed us to analyze users' viewing behavior by tracking the users' eye movements and fixations. Many previous studies have defined fixation as a gaze of 100 to 300 milliseconds as evidence of attention [11, 12, 28]. However, gazes as low as 60 ms have also been used to capture users' more transient focal point of view. To examine fixation patterns, we are using heat maps to illustrate participants' viewing behavior, showing how many times participants fixated on certain area of the page. Heat maps are created based on the number of ads showing on the search engine result page, using fixation count data of participants. Examples of heat maps are shown in Figure 1. Varying colors show the levels of fixation. Participants tend to fixate most frequently at areas with red color, less at areas with green and yellow. Participants didn't fixate at the areas with no color.

5. Results

We grouped the results based on the number of ads on SERPs. Because we used an actual real-time search, for each user a heat map based on fixation counts was created. We used Tobii's default setting for generating these heat maps. Samples of the heat maps are shown in Figure 1. Again because of our real-time search setting, some users had no advertisements; others had 1, 2, or 3 ads presented. The analysis of the heat maps indicated that users looked at the advertisements and the top entries of the SERPs. These results are consistent with the top-down viewing behavior as suggested by the model of visual hierarchy [15]. The fixation patterns for these users appear to favor the top portion of the entries, including the advertisements if present. Users seem to neglect the lower portion of the page, including the numbers listed for the additional pages of results.

Further, we expected all the users to ignore the advertisements generated by Google that were presented in the SERP. However, to our surprise, 77% of the users, who were presented ads, looked at the ads, contradicting the theory of banner blindness. The average fixation duration on an ad was 221 milliseconds. While this fixation duration is less than

what is often accepted as a more stringent indicator of cognitive processing (300 milliseconds), it passes the less stringent criteria for attention (100 milliseconds) [10].
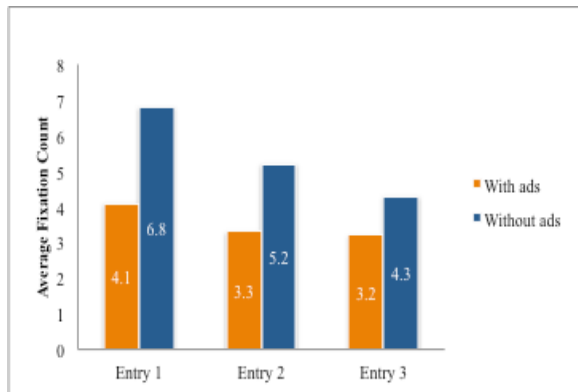

Figure 1. Heat maps

Figure 2. Fixation count: top 3 entries

Next, we looked at the distribution of fixations on the page. As seen in Figure 2 and Figure 3, fixation count and total fixation duration of the first three entries, when advertisements were not present, are much higher than when advertisements are present. These findings provide evidence to support the competition for attention theory with eye-tracking data. Moreover, for the time leading up to the first

action of clicking or scrolling and there were advertisements present, users looked at ads 10% of the time, entries 66% of the time, and other locations on the page (such as the search box) 34% of the time. Surprisingly, when ads were not present, users looked at entries 76% of the time, which is equal to the total fixation time of ads and entries when ads were present. They looked at other places on the page 34% of the time.
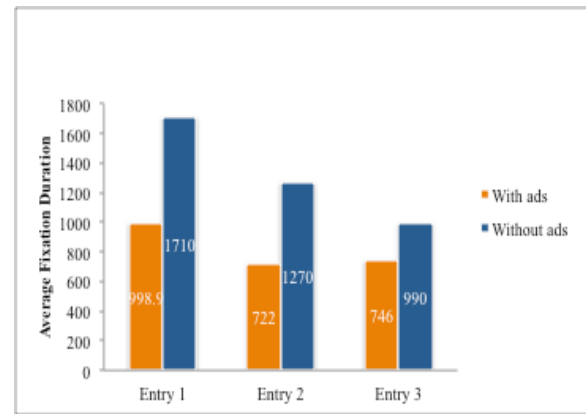

Figure 3. Fixation duration: top 3 entries

Further, we discovered that users looked at more entries (entries 1 – 9) when there were no ads, but only six entries (entry 1 – 6) when no ads were present. This is again consistent with competition for attention theory, suggesting that when ads were present, fewer entries were viewed. Table 1 provides the average fixation duration data for entry 1 through entry 9. The left side of the table displays these values when there were ads present, while the right side of the table displays values during the absence of ads. Duration values when no ad was present are the highest, decreasing with entry number. When ads were present, users exhibited lower duration times for the entries, providing additional support for the competition for attention theory.

Table 1. Average fixation comparison

Area of Interest (AOI)	With Ads		Without Ads	
	Avg. total fixation duration (ms)	Avg. fixation count	Avg. total fixation duration (ms)	Avg. fixation count
Entry 1	998.9	4.1	1710	6.8
Entry 2	722	3.3	1270	5.2
Entry 3	746	3.2	990	4.25
Entry 4	500*	4	910	3.57
Entry 5	--	--	1880*	5
Entry 6	70*	1	80*	1
Entry 7	--	--	380*	2
Entry 8	--	--	70*	1
Entry 9	--	--	170*	1
Note: * Entries viewed by fewer than 3 people, -- subjects did not look at this entry				

Observations of search behavior were made both during the testing period and after the testing period by reviewing the eye-movement recordings. We discovered evidence that supports Hong et al.'s [17] findings that users tend to scroll down and then return to the top of the page. When at least one advertisement was presented, 9% of the subjects clicked on an entry (as opposed to scrolling) as their first action. Nearly 54% of the subjects clicked on an entry as their first action when there were no ads presented.. Table 2 shows the relationship between the number of ads and the first action duration (the time elapsed up until first action). The amount of time it takes for the user to get to their first action (clicking or scrolling) has a significant relationship with the number of ads on the page. As the number of ads decreases, so does the first action duration.

Table 2. Regression results: ads vs. scene

	Stand. beta	t-value	Conf. interval
Ads	-.536*	-2.980	(-1.794, -.332)

Note: * significant at .05

6. Discussion

We started this study wanting to understand if the number of ads in a Google search affects the amount of attention given to returned search results. Findings support that during the viewing of SERPs, most users were attracted to not only entries, but also advertisements when using the less stringent attention criteria (100 ms). It is often assumed that the higher the placement of an entry the more attention it receives. In our study, advertisements were only produced in one of the two tasks completed. Our study, which focused on browsing search behavior in list format with SERPs, contributes to the existing literature on visual hierarchy. Results provided evidence that items that were placed on top of the page received more attention than items placed towards the bottom of the page. For marketers, this confirms that ads placed on the top of SERPs receive consumer attention, hence providing opportunities for revenue contributions. For user experience designers, this also confirms that the top portion of the page remains valuable real estate for communicating important information.

We expected that users who were looking for 'free screen recording' would not look at advertisements, because these ads were for paid software products. However, our results showed that the users did look at the ads, although they knew they were required to look for free offerings. We believe that this is good news for marketers, since the ads get

attention even at times when users are not necessarily looking for their products. However, our results showed that regardless of the number of ads present, users still only looked at one ad (e.g., see Figure 1). This highlights the importance of ranking of ads on SERPs.

Our findings also suggest that the presence of ads had an impact on the number of entries that were viewed following the ads. When ads were present, fewer entries were viewed. This suggests that ads had a negative impact on how deep the search results were examined. This in turn, may result in a negative impact on user experience by discouraging users from fully utilizing the search results presented. This could make it difficult for users to find the information they are searching for.

7. Limitations and Future Research

As with any laboratory experiment the generalizability of the results in our study is limited to the setting and the tasks used. First, the subjects were Generation Y users who have a very high level of experience using Google. Perhaps this introduced bias into our results. Second, the results are limited to the setting of this study. However, this setting allowed us to observe user experience in a real-time search environment, hence, this exploratory research served as an initial step for an upcoming series of studies surrounding viewing behavior and user experience. Future studies can extend our findings by including stimuli from controlled web resources, allowing for a more robust analysis. In addition, future studies can extend these results by examining different tasks and different search engines. In this study, we focused on banner ads, for the future side ads could be included.

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