

# SERPs and Ads on Mobile Devices: An Eye Tracking Study for Generation Y

Soussan Djamasbi, Adrienne Hall-Phillips, and Ruijiao (Rachel) Yang

User Experience & Decision Making Research Laboratory,  
Worcester Polytechnic Institute  
{djamasbi, ahphillips, rachel.yang}@wpi.edu

**Abstract.** We use eye tracking data to analyze the search behavior of Generation Y users when searching for information using a mobile phone. Following previous studies, we use Google as an example of list-based SERPs to explore the impact of advertisements in search results and their impact on attention before the user's first action on the page. Results provide evidence that the presence of advertisements and location on the screen can have an impact on user experience and search.

**Keywords:** Fixation, Generation Y, Search Engine Results Pages (SERPs), viewing behavior, mobile phone.

## 1 Introduction

Smartphone ownership among younger adults is growing rapidly. In 2012, the largest group of adults in US (66%), who owned a smart phone aged between 18 and 29 [19]. This group of young adults, commonly referred to as Generation Y, has integrated the use of smartphone technology into their everyday lives. The Internet, mobile phones, and laptop computers, have all impacted the way we communicate and interact with each other. The convenience of a mobile phone that is connected to the Internet allows for consumers to have information at their fingertips. In the US nearly 75% of users 18-24 who have a mobile phone, use this phone to access the Internet or read email [21]. As expected by their ongoing relationship with technology from an early age, Generation Y consumers are very tech savvy, making them an obvious target for companies wanting to sell to them [4,6].

As the market driver of technology products, the behavior of Generation Y has a great influence on product improvement. Understanding the search behaviors of this group of users can provide insight into where and what on the page is the most attractive. Further, gaining valuable insights of Generation Y 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. The Generation Y consumers have disposable income, early adoption tendencies, and a keen interest in all things web-based [14, 23]. In 2011, Internet advertising revenues rose 22% to an astounding \$31.74 billion, with 69% generated from advertisements in search and web page

banners [18]. Despite this trend from advertisers to continually increase web-based advertisement, consumers are still skipping ads, making it harder for marketers to find new ways of attracting attention for potential revenue generating clicks. We know this is true for desktop computing; however, does this same phenomenon of skipping advertisements exist when consumers are searching on a mobile phone?

For this study, we are interested in understanding the impact of advertisements on Generation Y users' search behavior on search engine result pages (SERPs) while using a mobile phone. Other studies have explored search behavior, concluding that lists are best for browsing search behavior (e.g., [9]; [10]), few studies have looked at the impact of ads on this search behavior, especially not in a mobile format. Following previous studies, we use Google's results pages as examples of list-based SERPs to explore the impact of advertisements in search results and their impact on attention before the first action is taken by the user [8].

## 2 Background

Previous studies have begun to shed light on users and their technology adoption and behavior with a focus on desktop (e.g. [2]). However, there is still a gap between the search behavior on a desktop and the search behavior on mobile technology. Continuing from previous work by Djasasbi et al. [4, 5] and Loos [11] we examine the search behavior of Generation Y users when using a web-based search engine via mobile phone. Taking it one step further, we aim to gain insight into the impact of advertisements on mobile-based SERPs. That is, would the presence of ads affect the attention to the first two entries that are relevant to users? We use Google for a number of reasons beyond ad-related purchases: Google is highly usable in terms of finding relevant information, and placing ads on Google SERPs has been a major source of revenue for Google and the companies placing the ads. Therefore, it is important to examine whether ads receive the needed attention and if so, whether their presence impacts the communication of relevant information embedded in search results.

### 2.1 Web Search Behavior of Generation Y

Web search behavior has been linked to visual marketing, Internet advertising, web usability, and web design [9, 13]. Viewing behavior is defined as a series of fixations [10] demonstrating which pieces of a stimulus are given attention. The viewing behavior of web pages was examined by Pan et al. [17], concluding that type of web page, design, style, and page order all impact a user's viewing experience. These studies provide proof that a ranking order per page can influence trust of an entry. Other studies have examined viewing attention and web pages [5, 12], but few have given special attention to the impact of advertisements and their impact on search results, particularly for Generation Y users. Until now, studies have explored a user's eye movements on a search results page [7], the impact of specific tasks [12], and general viewing behavior [4, 6]. Little work has been done to examine Generation Y's search behavior on mobile phones. This study is a preliminary exploration of Generation Y's viewing of search results pages on a mobile phone.

## 2.2 Banner Blindness

The term *banner blindness* refers to skipping banner ads on a webpage [9]. Users tend to overlook advertisements and focus more on web results and other webpage enhancements [1]. While advertisers and marketers carefully craft their messages to draw viewer's attention, studies continue to confirm users tendency to 'act blind' towards web advertisements [3, 13, 15, 16]. Internet users have learned how to not be distracted by web advertisements, demonstrating that they are 'functionally blind' to them altogether [1, 2]. Some users exhibit blindness to text advertisements as well as imaged-based advertisements [15]. Ignoring ads may help users to be more focused in their search, however, it can also cause users to miss information that is helpful to them..For example, web advertisements that are used to solicit clicks often provide sponsored links related to a keyword search.

## 3 Methodology

Banner blindness provides a basis for this exploratory study which examines the search behavior of Generation Y users. Would the presence of ads affect the attention to search results on a mobile phone? Do users spend more time looking at advertisements than at entries? Can advertisements distract users' attention from the search results? To address these questions we conducted an exploratory eye tracking experiment. Eye tracking data was collected for search behavior on a mobile device. All participants were Generation Y users. During the study, participants were required to carry out two web-based searches using Google on an Apple iPhone. All search queries were made using the real-time Google search engine. Results were not altered in any way, allowing for a pure mobile user-experience environment.

### 3.1 Measurements

We used the Tobii X120 eye tracker to capture users' eye movements. We used Tobii studio's default setting of 60 milliseconds for gaze duration because prior research indicates that people can read text during fixations that are as short as 50 milliseconds [20]. We examined users' click and scroll behavior, fixation duration on SERPs and advertisements. We also examined fixation patterns, which are typically studied through heat maps [e.g., 6]. Varying colors show the levels of fixation duration with red indicating the longest fixations, followed by yellow and green showing lesser amounts of fixation (Figure 2). Participants did not fixate on the areas that show no heat map coloration..

### 3.2 Participants and Design

Participants were drawn from a pool of students in a major university in the US. Sixteen male and female users (7 female, 9 male) completed two search tasks. Participants were all Generation Y users and ranged in age from 20 to 24. All the

participants self-reported that they were very familiar with using the Google search engine. All but three participants were smartphone owners, who use their smartphones for searching for information at least weekly.

### 3.3 Task

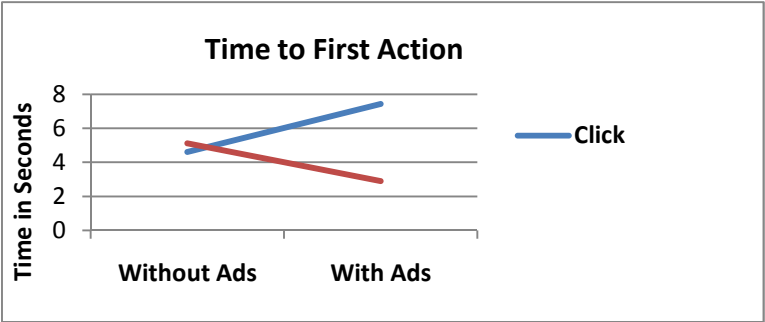
Participants used the Google search engine on a mobile phone to search for specific information based on the assigned task. Each participant completed two tasks in a random order. Participants were required to type in a given phrase in the search box and then look for specific information on the search results page. For example, in task 1, participants were asked to assume that they were required to use free screen recording software for their course work. They were then asked to type in the phrase “free screen recording software” in the search box and then look for a free screen recording software that they would use for their coursework. In task 2, participants were asked to use the phrase “best snack in Boston” to find a snack place in Boston that they would like to visit with their friends. Because we were interested in search behavior on SERPs, the eye movement data for the time before the SERP was loaded on the mobile device was not included in the analysis.

## 4 Results

Our study provides an exploratory examination of how Generation Y users use a mobile phone and Google search engine to look for information. In order to see whether ads had an impact on users’ viewing behavior we examined users’ click and scroll behavior, viewing pattern, and fixation duration.

**Click/Scroll Behavior. As a function of our real-time study environment, subjects were presented with 1, 2, or no ads. Forty percent of the sample received search results with ads. The analysis of data showed that on average, it took people about 5 seconds to take their first action (either scroll or click on an entry). The data also showed that 63% of our sample scrolled after viewing the entries on the SERP, while 37% clicked on an entry as their first action. According to our analysis, it took slightly longer to click (mean= 5.86, SD= 3.07) than to scroll (mean= 4.22, SD= 1.82) as the first action.**

Time for taking the first action seemed to be unaffected by the presence of an ad. There was no substantial difference between the amount of time it took for users to take their first action (scroll or click) when ads were present (mean= 3.21, SD= 2.24) or absent (mean= 3.08, SD= 1.74) on the SERP. This was not the case when we looked at click and scroll behavior separately. When ads were present users took much longer to click (mean= 7.43, SD= 4.10) than to scroll (mean= 2.89, SD= 1.49) when ads were absent click (mean= 4.60, SD= 1.36) and scroll (mean= 5.12, SD= 2.55) behaviors were more similar (Figure 1).



**Fig. 1.** Time to first action based on action type and presence/absence of ads

Viewing Pattern. Heat maps displaying fixation duration on SERPs were created (Figure 2). The heat maps showed that users paid attention to ads. Eighty two percent of the users who were presented ads viewed at least one ad. A recent study showed that headings received a substantial amount of fixation in textual messages [6]. Similarly, the heat maps in our study showed that headings received intense fixations.



**Fig. 2.** Heat maps

Users’ fixation duration for the first screen as well as fixation duration for ads and entries on the first screen was also analyzed. This analysis showed that average fixation duration on the first screens with ads (mean= 3.21, SD= 2.34) was slightly longer than the average fixation duration on first screens without ads (mean= 3.08, SD= 1.74) (Figure 3).

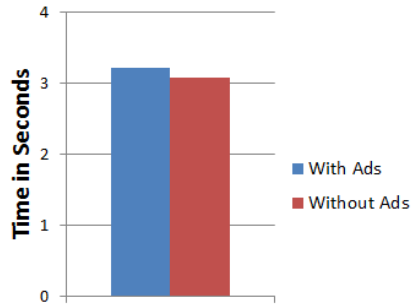


Fig. 3. Average Fixation Duration for the Screen

Looking at the fixation duration on items (ads and entries) on the first screen we found that on average the fixation duration on the first entry was longer (mean=1.84, SD=1.41) than fixation duration on the second entry (mean=1.38, SD=0.89). The first entry attracted longer fixation whether ads were present or not (Figure 4).

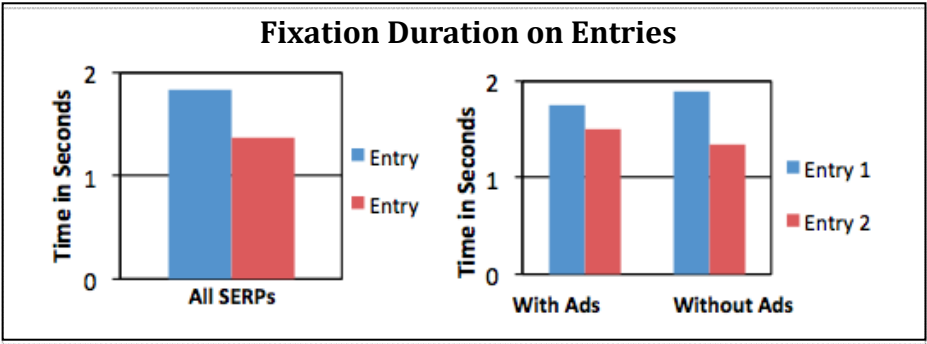


Fig. 4. Fixation Duration on Entries

Next, we examined the distribution of fixation on the screen. For the time leading up to the first action of clicking or scrolling and when advertisements were present, users looked at ads an average of 28% of the time, entries 41% of the time, and other locations (such as the search bar or empty space) 31% of the time. For the time leading up to the first action of clicking or scrolling and there were no advertisements present, users looked at entries 64% of the time, and other locations on the page (such as the search bar) 36% of the time (Figure 5). This data suggests that ads have an impact on distribution of attention on the screen.

Finally, we looked at the order of fixations. In general, it took about 0.16 seconds for participants to locate the first item that attracted their attention regardless if ads were present or absent. However, when ads were present, the first ad was the first item that was viewed followed by the first entry (most users skipped the second ad) and then the second entry. When ads were absent, the entries were viewed in a top down fashion.

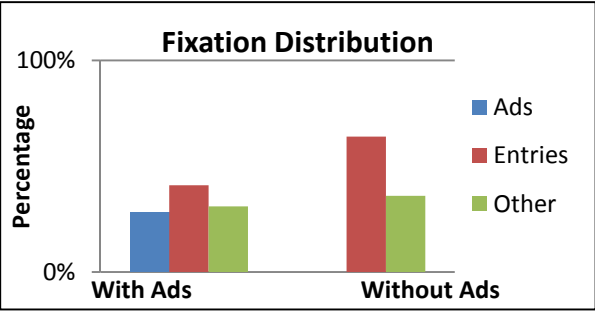


Fig. 5. Fixation Distribution

When ads were present on SERPs, the first ad and the entries received the attention of 90% of users. When ads were absent the first entry was viewed by 100% of the users, the second entry by 86%, and the last entry by 14%, resulting in the last entry receiving the least amount of attention. This search behavior suggests that ads affected the distribution of attention to items displayed on the screen. The results indicate that Generation Y did not exhibit banner blindness. Further, when ads were absent the entries at the bottom of the screen received much less attention by Generation Y users compared to items that were placed above them.

## 5 Discussion

We started this exploratory study wanting to understand how Generation Y users search for information on a SERP using a mobile phone. We also wanted to understand if a web advertisement impacted this search behavior. Our analysis shows that participants viewed the SERP for about 5 seconds before either clicking or scrolling and that it took them about 0.16 seconds to fixate on the first item that attracted their attention. Because of the limited screen space on a mobile phone, we expected to see most users choose scrolling as their first action. While the results confirmed this expectation, they showed that about one third of our participants chose to click on an entry as their first action. Given the limited number of items that can be displayed on the screen of a mobile phone, these results suggest that top locations on a SERP may be particularly important for mobile phones. These results also highlight the importance of top locations for Generation Y users, who tend to exhibit a less patient viewing behavior than older generations [4].

Our data showed that in general the time it took to click on an entry was longer than the time that took to scroll. This behavior suggests that clicking required slightly more cognitive processing for Generation Y users than scrolling. This difference between the times for these two actions may be because clicking results in moving away from the SERP and thus requiring more careful appraisal. Future research is needed to examine this possibility more directly.

The amount of time that Generation Y users took to take their first action seemed to be unaffected by the presence of the ads on the SERP. The ads, however, impacted the timing of click and scroll behavior. When ads were present users scrolled much faster than they clicked. When ads were absent the amount of time that took

participants to either click or scroll was only slightly different. The ads also impacted the distribution of fixation. When ads were present, they received 28% of the total fixations. When they were absent, search results and other locations on the SERP received a larger proportion of attention. These results indicate that a good portion of Generation Y users' fixations were directed toward ads when they were present. Hence the results show that our participants did not exhibit banner blindness. This is particularly good news for web designers and marketers who are charged with directing users' attention to purchase-inducing product promotions.

During the viewing of SERPs on a mobile phone, most Generation Y users viewed both entries and advertisements. However, users often looked only at one ad, the one that was displayed first. This viewing behavior suggests that placing more than one ad on mobile SERPs may not be an effective strategy for marketing to Generation Y users. Looking at the order of fixations, we found out that Generation Y users exhibited a top down viewing behavior, scanning the items from top to bottom of the screen. However, when more than one ad was present, most users skipped the second ad and moved on to viewing the entry placed under the second ad. Interestingly enough, when the SERP did not include ads, the last item on the screen attracted the attention of only a small percentage of users (14%). These observed viewing patterns are consistent with the theory of visual hierarchy, which is often used to explain viewing pattern of web pages [4]. According to this theory the top areas on a web page are more likely to receive attention than bottom areas on the page. This behavior seems intuitive for viewing webpages displayed on desktop or laptop computers, which can hold a large number of items. On a small screen such as those of mobile phones, one may argue that location is less likely to have a big impact on viewing behavior. Our results, however, show that the location of items on a mobile phone SERP has an impact on the amount of attention they receive from Generation Y users.

## 6 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 participants were Generation Y users who had a very high level of experience using Google. Future research is needed to test whether the findings of this study applies to other age groups with varying level of expertise. Second, the results are limited to Google SERPs. Future studies can extend our findings by including stimuli from other search engines. Finally, the small sample size is another limitation of this study. It is often possible to detect major usability issues with a small number of participants. Hence many eye tracking usability studies, particularly industry research, often involve a small number of participants [22]. While this is a successful approach in finding major issues efficiently and cost effectively, it naturally yields to low statistical power and thus makes it difficult to find statistically significant results. As in many prior usability studies, due to our small sample size, the power of statistical tests in our study was relatively low, and hence none of the differences in our study were statistically significant at 0.05 level. Future research with increased sample sizes is needed to test whether the non-significant differences in our study become significant.



## 7 Contribution

Our study, which focused on Generation Y searching for information via a mobile phone, contributes to the existing literature on Generation Y's viewing behavior and banner blindness. Results provide evidence that ads and entries placed on mobile SERPs receive Generation Y's attention, and that ads are not overlooked. However, the results suggest that placing more than one ad on top of the SERPs may not be effective in marketing to Generation Y users. For marketers, these results provide insight for increasing opportunities for revenue contributions. For user experience designers, the results confirm that the top portion of the page remains valuable real estate for communicating important information, even in the mobile phone format.

## References

1. Chatterjee, P.: Are unclicked ads wasted? Enduring effects of banner and pop-up ad exposures on brand memory and attitudes. *Journal of Electronic Commerce Research* 9, 51–61 (2008)
2. Cutrell, E., Guan, Z.: What are you looking for?: an eye-tracking study of information usage in web search. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp. 407–416. ACM, San Jose (2007)
3. Desimone, R., Duncan, J.: Neural mechanisms of selective visual attention. *Annual Review of Neuroscience* 18, 193–222 (1995)
4. Djamabsi, S., Siegel, M., Tullis, T.: Generation Y, web design, and eye tracking. *International Journal of Human-Computer Studies* 68, 307–323 (2010)
5. Djamabsi, S., Siegel, M., Skorinko, J., Tullis, T.: Online Viewing and Aesthetic Preferences of Generation Y and the Baby Boom Generation: Testing User Web Site Experience Through Eye Tracking. *International Journal of Electronic Commerce* 15, 121–158 (2011)
6. Djamabsi, S., Siegel, M., Tullis, T.: Faces and Viewing Behavior: An Exploratory Investigation. *AIS Transactions on Human-Computer Interaction* 4, 190–211 (2012)
7. Granka, L.A., Joachims, T., Gay, G.: Eye-tracking analysis of user behavior in WWW search. In: *27th Annual International Conference on Research and Development in Information Retrieval - SIGIR 2004*, pp. 478–478. ACM Press, New York (2004)
8. Hall-Phillips, A., Djamabsi, S., Yang, R.R.: Do Ads Matter? An Exploration of Web Search Behavior, Visual Hierarchy, and Search Engine Results Pages. In: *Proceedings of the 46th Annual Hawaii International Conference on System Sciences (HICCS)*, pp. 1–7. Computer Society Press (2012)
9. Hong, W., Thong, J.Y., Tam, K.Y.: The effects of information format and shopping task on consumers' online shopping behavior: A cognitive fit perspective. *Journal of Management Information Systems* 21, 149–184 (2005)
10. Janiszewski, C.: The influence of display characteristics on visual exploratory search behavior. *Journal of Consumer Research* 25, 290–301 (1998)
11. Loos, E.: In search of information on websites: A question of age? In: Stephanidis, C. (ed.) *Universal Access in HCI, Part II, HCII 2011*. LNCS, vol. 6766, pp. 196–204. Springer, Heidelberg (2011)
12. Lorigo, L., Haridasan, M., Brynjarsdóttir, H., Xia, L., Joachims, T., Gay, G., Pan, B.: Eye Tracking and Online Search: Lessons Learned and Challenges Ahead. *Journal of the American Society for Information Science and Technology* 59(7), 1041–1052 (2008)

13. Morkes, J., Nielsen, J.: Concise, SCANNABLE, and Objective: How to Write for the Web. Nielsen Norman Group (1997), <http://www.nngroup.com/articles/concise-scannable-and-objective-how-to-write-for-the-web/> (accessed on February 28, 2013)
14. Neuborne, E., Kerwin, K.: Generation y. *Business Week*, pp. 46–50 (1999)
15. Owens, J.W., Chaparro, B.S.: Text Advertising Blindness: The New Banner Blindness? *Journal of Usability Studies* 6, 172–197 (2011)
16. Pagendam, M., Schaumburg, H.: Why are users banner-blind? The impact of navigation style on the perception of web banners. *Journal of Digital Information* 2 (2006)
17. Pan, B., Gay, G.K.: The Determinants of Web Page Viewing Behavior: An Eye-Tracking Study. In: Spencer, S. (ed.) *Proceedings of Eye Tracking Research & Applications*, pp. 147–154. ACM, New York (2004)
18. Purcell, K., Brenner, J., Rainie, L.: Search Engine Use 2012. Pew Internet & American Life Project (2012), <http://www.pewinternet.org/Reports/2012/Search-Engine-Use-2012.aspx> (accessed on February 28, 2013)
19. Rainie, L.: Smartphone Ownership Update: September 2012, vol. 2012. Pew Internet & American Life Project (2012), <http://pewinternet.org/Reports/2012/Smartphone-Update-Sept-2012.aspx> (accessed on February 28, 2013)
20. Rayner, K.: Eye movements and attention in reading, scene perception, and visual search. *The Quarterly Journal of Experimental Psychology* 62, 1457–1506 (2009)
21. Smith, A.: Cell Internet Use 2012, p. 16. Pew Internet & American Life Project (2012), <http://www.pewinternet.org/Reports/2012/Cell-Internet-Use-2012.aspx> (accessed on February 28, 2013)
22. Tullis, T., Albert, W.: *Measuring the user experience: collecting, analyzing, and presenting usability metrics*. Morgan Kaufmann (2008)
23. Waters, J.: Young, with tons of purchasing power. *Market Watch*, *The Wall Street Journal Digital Network* (2006)