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Banner Advertisement Placement on Desktop Computers and Smartphones:
The Influence of Platform and Location on Post Viewing Recognition

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Banner advertisements are among the most common form of advertisements appearing on computing platforms (Flores, Chen, and Ross, 2014). A banner ad is defined as an "on-line advertising space that typically consists of a combination of graphic and textual content and contains an internal link to target ad pages (the advertiser's information on the host site) or an external link to the advertiser's Web site via a click through URL" (Chatterjee, 2005, p. 51). Such advertisements appear on different computing platforms such as desktop computers, laptop computers, and smartphones while users interact with the Internet. Advertisers spend a significant amount of money on such advertising (eMarketer, 2012; Sigel, Braun, & Sena, 2008) so research investigating the characteristics that make banner ads effective should prove useful in determining how to best allocate advertising resources.

This manuscript describes the results of an experimental study that examined the effects of two characteristics of banner ads on ad recognition: screen location (top of screen and bottom of screen), and platform (desktop and smartphone). This is one of the first studies in the comparative analyses between desktop and smartphone advertising design practices. Participants were randomly assigned to one of four groups and completed a reading comprehension task. Information was displayed on either a desktop computer or on a smart phone screen with a banner ad placed at either the top of the screen or bottom of the screen. After the participants finished reading the information and turned off the displays they were required to identify the banner ad that was displayed from a set of four banner ads containing the ad that was displayed on screen and three distractor ads. Results indicate that both platform and position effected the recognition hit rate of the participants. Higher hit rates were achieved for a banner ad displayed on the desktop screen over one displayed on the smartphone. In addition, higher hit rates were achieved for a banner ad displayed at the bottom of the screen as opposed to a banner ad displayed at the top of the screen. These results have implications for determining the potential impact of banner ads on webpages which may justify different advertising charge rates for different banner ad locations.

Background and Hypothesis Development

Determining the effectiveness of banner ads in computing environments first requires an understanding of how readers interact with the Web. Viewers of information on the Web may engage in at least two different types of information processing tasks: reading comprehension or "lateral reading" (a.k.a. "power browsing") when people rapidly skim across search results and websites (Dobler and Eagleton, 2015; Miller and Bartlett, 2012; Walraven et al., 2009). Accordingly, the effectiveness of banner advertisements on websites may be significantly influenced by the nature of the readers' web interacting task: either information processing or skimming. A reader who skims webpages may comprehend and remember the content of a banner ad differently than a reader who more completely processes the information on a webpage. For this investigation the reader's task was defined and set as an information processing task whereby readers were required to complete a reading comprehension task of information presented on a webpage. Accordingly, the task required the reader to spend a significant amount of time viewing the webpage to process the information presented. As will be discussed later, banner ads were placed either at the top of the textual material that was to be read or at the bottom.

Information Processing

A reading comprehension task with a banner ad displayed on the webpage is akin to a running memory task whereby readers process a continuous input stream of information (Moray, 1981; Wickens and Carswell, 2012). Information comprehension and memory in such a task may be affected by viewing time and by recency of occurrence. First, the longer the item, in this case the banner ad, is in view the higher the probability the item will be remembered. Second, the position of the item within the continuous input stream may impact memory due to a recency effect. The recency effect is the observation that memory of an item is usually superior if the item appears at the end of a continuous input

stream (Schwartz, 2014). These two factors are addressed in the following sections in regard to the computing platform on which information is displayed.

Platform – Desktop Computer versus Smartphone

The most significant difference between the display of information on a desktop computer and the display of information on a smartphone is the size of the display screen. A desktop computer with a 17 inch monitor has a display area of approximately 108 square inches depending upon the size of the bezel (the frame around the display screen). In contrast, the display area of a smartphone screen ranges from five square inches to ten or more square inches depending upon the model. This difference in screen size obviously determines the amount of information that can be displayed at one time on a single smartphone screen. Websites that are designed to be viewed on both desktop computers and smartphones are structured such that a single screen of text that appears on the desktop will require multiple screens on a smartphone. Both the layout and text font are adjusted for display on a smartphone. For example, the textual content of a single desktop screen from www.webmd.com, a popular medical information website, requires two or more smartphone screens for display. A user must scroll through the multiple smartphone screens to read the same content that appears on a single desktop screen.

A banner ad that is displayed along with the textual material will, therefore, appear to the reader for a longer period of time on the desktop screen than on the smartphone screen. The banner ad will remain in the view of a reader during the entire time that the reader processes a single page of text on a desktop screen. In contrast, the banner ad will remain in view of the reader only for as long as the reader is viewing the subset of textual material on the smartphone screen that contains the banner ad. The subset of textual material and the banner ad will disappear from view when the reader scrolls away from that screen on a smartphone.[1] This disparity in banner ad viewing time between the desktop screen and smartphone screen leads to the following hypothesis:

> **H1:** Post viewing recognition of a banner ad will be higher for banner ads displayed on desktop screens than displayed on smartphones.

Banner Ad Position – Top of Screen versus Bottom of Screen

Banner ads may be placed in several positions on a computing screen: Top, bottom, side, and embedded within the content displayed. The position of the item within a continuous input stream of textual material in a reading comprehension task may impact memory due to a recency effect. As noted above, the recency effect is the observation that memory of an item is usually superior if the item appears at the end of a continuous input stream (Schwartz, 2014). A banner ad placed at the bottom of a display screen will be the last (most recent) item viewed by a reader completing a reading comprehension task. This is true for banner ads displayed on both desktop and smartphone screens and leads to the following hypothesis:

> **H2:** Post viewing recognition of a banner ad will be higher for banner ads displayed at the bottom of a display screen than at the top of the display screen.

Research Method

A laboratory experiment was conducted to test the hypotheses set forth above. The authors recruited 160 upper-division students from a large university to complete the exercise. The participants were given a nominal level of extra-course credit (approximately two percent of the total course points) as

[1] Another type of banner ad is the so-called “sticky” banner ad that does not scroll with the page on mobile devices. Instead sticky banner ads remain visible as the user scrolls through the underlying text. Sticky banners are not explored in this study.

an incentive to complete the exercise. The majority of the participants were male and younger than 25 years of age. All participants convened at a pre-established time in a lab with the authors present to provide instruction and were randomly assigned to view and read information from a webpage in one of four treatment conditions:

1. On a ***desktop computer*** with a banner ad positioned at the ***top*** of the screen.
2. On a ***desktop computer*** with a banner ad positioned at the ***bottom*** of the screen.
3. On an ***Apple iPhone 5s smartphone*** with a banner ad positioned at the ***top*** of the screen.
4. On an ***Apple iPhone 5s smartphone*** with a banner ad positioned at the ***bottom*** of the screen.

The task required the participants to carefully read the content of the webpage containing information about a medical condition. After reading the information the participant closed the webpage and completed a ten question quiz about the information they had read. All participants achieved high scores on the quiz indicating that they comprehended the information that was displayed.[2] There was no mention made of the banner ad that was displayed. Upon completing the quiz each participant was shown a random ordering of four banner ads: three distractors and the one that was displayed on the webpage they viewed. Their final task was to identify the banner ad that was displayed on the webpage.

Webpage and Banner Ad Displayed

As noted above, the webpage displayed to each participant contained information about a medical condition. Shingles was chosen as the medical condition given that it is an actual malady but most likely unknown to the participants as it effects older people. Responses from a post experimental questionnaire indicated that participants had a low level of knowledge of shingles prior to completing the reading comprehension task. Appendix A contains the textual information displayed.

The font size, form, and layout of the webpage was modeled after webpages displayed on www.webmd.com, a popular medical information website. The textual information describing shingles was edited so that it would appear in its entirety on a single desktop computer screen. The same content was formatted to display on the screen of an iPhone 5s smartphone. Following the font size, format, and layout employed by the webmd website, the same information required participants to scroll through **three** screens on the iPhone 5s. These layouts mimic the differences in the display of information across both platforms: a single page on the desktop corresponding to three pages on an iPhone 5s smartphone. This allowed an examination of hypothesis **H1** which predicts a higher post viewing recognition of a banner ad displayed on the desktop as the ad appears during the entire time that the reader views the content of the webpage. In contrast, the ad appears for approximately one-third the viewing time on the smartphone.

The banner ad that was displayed was created by a graphic artist and is shown in Figure 1.a. It depicted a fictitious product, logo, and tag line so participants would be completely unfamiliar with the banner ad and its content. The same banner ad was displayed to participants in all four treatment conditions. Accordingly, it appeared on both the desktop screen and smartphone screen and either at the top or bottom of the textual material displayed. The size and layout of the banner ad as displayed on both screens conformed to standard industry practice (http://mobiletheory.com/advertisers/ad_specs/ and http://www.idev101.com/code/User_Interface/sizes.html). Displaying the banner ad at both the top and bottom of the textual material on both platforms allows an examination of hypothesis **H2** which predicts that due to recency effects, post viewing recognition of a banner ad will be higher for banner ads displayed at the bottom of a display screen.

[2] Seventy-one percent of the participants earned a score of 100% on the quiz, 25% earned a score of 80% on the quiz, and the lowest scores of 60% were earned by the remaining 4% of the participants.

Figure 1

Banner Ads Used in Study

a. Banner Ad Displayed on Participant's Webpage
Fictitious Product, Logo, and Tag Line

b. Three Distractor Banner Ads Used to Solicit Post Viewing Recognition
Fictitious Products, Logos, and Tag Lines

Recognition Task – Dependent Variable

As noted above, after completing the ten question quiz over the textual information displayed on screen each participant was shown a random ordering of four banner ads: three distractors and the one that was displayed on the webpage they viewed. The recognition task required the participant to identify the banner ad that was displayed on the webpage they viewed. The randomization eliminated order effects in the presentation of the banner ads. The three distractor banner ads were created by a graphic artist and are shown in Figure 1.b. Each depicted a fictitious product, logo, and tag line so participants would be completely unfamiliar with all banner ads and their content.

The recognition task devised for this study is one of several possible measurement tasks that can be used to probe the participants' memory for traces of awareness of an advertisement or brand (Du Plessis, 2005). As such, this measurement of effectiveness provided the dependent variable to be used in testing the hypotheses: Participant hit rate resulting from correctly identifying the banner ad that was displayed with the textual information they read on screen.

Results and Analysis

Table 1 displays the hit rate percentages for each of the two banner ad display treatment conditions: Desktop screen versus smartphone screen (platform), and top of text versus bottom of text (position). The data in the top panel of Table 1 indicates that the participants had a higher recognition hit

rate of the banner ad when that banner ad was displayed on the desktop computer screen (75.31%) versus the recognition hit rate for the banner ad displayed on the smartphone screen (56.96%). This result provides support for hypothesis **H1:** Post viewing recognition of a banner ad will be higher for banner ads displayed on desktop screens than on smartphone screens (Chi-square: p = .007).

Table 1

Results for 160 Participants
Hit Rates for Two Treatment Conditions

Platform		
	Desktop	**iPhone**
Hit Rate	75.31%	56.96%

Position		
	Top	**Bottom**
Hit Rate	60.00%	73.33%

The data in the bottom panel of Table 1 indicates that the participants had a higher recognition hit rate of the banner ad when that banner ad was displayed at the bottom of the textual material displayed on screen (73.33%) versus the recognition hit rate for the banner ad displayed at the bottom of the textual material displayed on screen (60.00%). This result provides support for hypothesis **H2**: Post viewing recognition of a banner ad will be higher for banner ads displayed at the bottom of a display screen than on the top of the display screen (Chi-square: p = .038).

Summary and Discussion

This study presents the results of an experiment investigating the effect of banner ad screen location (top of screen and bottom of screen) and the effect of platform (desktop and smartphone) on post viewing ad recognition. Participants were randomly assigned to one of four groups and completed a reading comprehension task. The information was displayed on either a desktop computer or on a smart phone screen, and a banner ad was placed at either the top of the screen or bottom of the screen. After the participants finished reading the information and turned off the displays they were required to identify the banner ad that was displayed from a set of banner ads containing the ad that was displayed on screen and three distractor ads. Results indicate that both platform and position effected the hit rate of the participants. Higher recognition hit rates were achieved for the banner ad displayed on the desktop screen over those displayed on the smartphone. In addition, higher recognition hit rates were achieved for the banner ad displayed at the bottom of the screen as opposed to the banner ad displayed at the top of the screen. These results have implications for determining the potential impact of banner ads on webpages.

Implications

Information regarding the higher recognition rates for banner ads displayed on different platforms and in different locations could be used to establish appropriate proportional advertising fees dependent upon banner ad placement. For example, a proportionately higher advertising rate could be charged for a banner ad that appears at the bottom of a display screen than for the top of the display screen. Modifying the rate is justified to reflect the 13% improvement in recognition hit rate achieved for the banner ad displayed at the bottom of the screen. A similar differential charge rate would apply in the case where a given banner ad was predominantly viewed on a desktop computer as opposed to a smartphone screen, thus reflecting the 18% improvement in recognition hit rate achieved for the banner ad displayed on the desktop screen.

Limitations

Some limitations of the current study should be noted. First, the participant pool was comprised of university students so the results may differ for participants in other demographics. The psychological findings related to both running memory tasks and recency effects are, however, reasonably generalizable across participant pools (Moray, 1981; Wickens and Carswell, 2012; Schwartz, 2014). Second, the sizes of the desktop screens and smartphone screens utilized in the experiment were fixed and allowed a comparison of only two alternative sizes: 17 inch monitors and iPhone 5s smartphone screens. The results may be different with screens of differing sizes, a potentially interesting topic for future research. Finally, the task completed by the participants was fixed as a reading comprehension task in order to apply the theoretical predictions related to a running memory task (Moray, 1981; Wickens and Carswell, 2012). Results could be different for a lateral reading or power browsing task (Dobler and Eagleton, 2015; Miller and Bartlett, 2012). Again, the investigation of banner ad recall using alternative tasks is a potentially interesting topic for future research

Future Research

In addition to future research related to alternative screen size and viewing task noted above, future research could also examine alternative placement positions of banner ads such as in a side bar or embedded within the primary screen content. Moreover, future research could examine the impact of other banner ad features such as color, size relative to total viewing area, and dynamic features such as banner ads that contain flashing and changing components. Finally, the examination of “sticky” banner ads on mobile devices could be examined. Sticky banner ads do not scroll with the text but remain visible as the text scrolls. Examining sticky ads would allow systems designers to determine the relative impact of that design alternative as compared to non-sticky banner ads.

Appendix A
Textual Information about Shingles

Shingles

What is shingles?

Shingles is a painful skin rash caused by the varicella zoster virus. Shingles usually appears in a band, a strip, or a small area on one side of the face or body. It is also called herpes zoster.

Shingles is most common in older adults and people who have weak immune systems because of stress, injury, certain medicines, or other reasons. Most people who get shingles will get better and will not get it again.

What causes shingles?

Shingles occurs when the virus that causes chickenpox starts up again in your body. After you get better from chickenpox, the virus "sleeps" (is dormant) in your nerve roots. In some people, it stays dormant forever. In others, the virus "wakes up" when disease, stress, or aging weakens the immune system. Some medicines may trigger the virus to wake up and cause a shingles rash. It is not clear why this happens. But after the virus becomes active again, it can only cause shingles, not chickenpox.

You cannot catch shingles from someone else who has shingles. But there is a small chance that a person with a shingles rash can spread the virus to another person who has not had chickenpox and who has not gotten the chickenpox vaccine.

What are the symptoms?

Shingles symptoms happen in stages. At first you may have a headache or be sensitive to light. You may also feel like you have the flu but not have a fever.

Later, you may feel itching, tingling, or pain in a certain area. That is where a band, strip, or small area of rash may occur a few days later. The rash turns into clusters of blisters. The blisters fill with fluid and then crust over. It takes 2 to 4 weeks for the blisters to heal, and they may leave scars. Some people only get a mild rash, and some do not get a rash at all.

It is possible that you could also feel dizzy or weak, or you could have long-term pain or a rash on your face, changes in your vision, changes in how well you can think, or a rash that spreads. If you have any of these problems from shingles, call your doctor right away.

How is shingles treated?

Shingles is treated with medicines. These medicines include antiviral medicines and medicines for pain. Starting antiviral medicine right away can help your rash heal faster and be less painful.

Good home care also can help you feel better faster. Take care of any skin sores, and keep them clean. Take your medicines as directed. If you are bothered by pain, tell your doctor. He or she may write a prescription for pain medicine or suggest an over-the-counter pain medicine.

Who gets shingles?

Anyone who has had chickenpox can get shingles. You have a greater chance of getting shingles if you are older than 50 or if you have a weak immune system.

There is a shingles vaccine for people who are 50 years and older. This lowers your chances of getting shingles and prevents long-term pain that can occur after shingles. And if you do get shingles, having the vaccine makes it more likely that you will have less pain and your rash will clear up more quickly.

Source: WebMD.com

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