Evaluating the Unaccounted Cost of Distraction of Display Ads to the Users

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ABSTRACT

Displaying advertisements is the primary business model for most of the content and services on the web. The ads provide free web services to a user in return for an advertising distraction cost. Understanding this distraction cost of ads may be essential in order to further improve and streamline the user-experience and business model of the web.

In this paper, we address the issue of evaluating the cost of distraction from display ads to users. Our study is divided into two stages, the latter stage being the primary focus of the paper. In the first stage, we summarize the results of an extensive user-survey. This survey provided a qualitative understanding of the user pain points with today's ads and their delivery. The survey pointed to us that it is not the ads themselves, but their effect on webpage navigation, which is considered a major inconvenience by the users. Based on this survey, we designed the second stage which allowed us to provide some preliminary quantification of the inconvenience of the ads to the users.

In the second stage of our research, we conducted a between-subjects user study where two groups of users are given the same tasks to find answers from popular web sites: one group with the ads displayed and the other without them. The task of finding answers from the web resembles an information way finding task. The results showed that the user navigation times were significantly longer when display ads are present. We also discovered that the number of images on a page is the most significant variable to determine the amount of navigation time increase. In conclusion, both the subjective survey and objective measurements obtained suggested that display ads have a negative impact to users. Design factors most egregious to navigation will be described.

Categories and Subject Descriptors

H.1.2 [**Models and Principles**]: User/ Machine Systems -- *human factors, human information processing*; H.5.4 [**Information Interfaces and Presentation**]: Hypertext/ Hypermedia -- *user issues, navigation*; J.4 [**Computer Applications**]: Social and Behavioral Sciences -- *economics*

General Terms

Economics, Experimentation, Human Factors

Keywords

Internet Advertisement, Usability Study.

1. INTRODUCTION

In a very short time, the web and the internet has become an integral part of our life. One of the reasons for this spectacular growth is that most of the web has been free to the users. All kinds of web services, whether it is an email service such as Hotmail, web-portal such as Yahoo, a social network such as Facebook, a video service such as Youtube, a news website such as New York Times, or a web search engine such as a Google, are free. Many of these web services require billions of dollars of investment whether it is in terms of Research and Development, or in terms of infrastructure such as servers, storage, bandwidth, and energy. At the very high level, these services are free because of the following two reasons [2]: One, once these services are developed, it takes very little money to provide the services to another user, i.e., web services typically have a low marginal cost. Two, this little money can potentially be earned back together with the base investment by displaying advertisements to the users. There are of course many interesting economics questions one can ask related to this business model which is both fueling the growth of the free web and also becoming a cause of struggle for many businesses, such as news delivery [15]. The focus of our paper is on the user experience and not on the economics issues.

A website may be free in terms of monetary payments, but the users may still be paying in terms of suboptimal user experience. We define the decrease in the user experience as a difference between the user experience a website could provide when it is fully optimized for the users and the user experience a website provides when it is partially optimized for the advertisers in order to earn some revenue for the website publisher. For the sake of quantifying the user experience, we use the "time wasted" as a proxy for estimating the decrease in the user experience. Even though, the focus of the paper is not economics, understanding the cost of ad distraction to the users may eventually be helpful in streamlining the advertising business model for the web. Currently web-search is the only major web service which takes this user cost directly into account in their advertising systems [9].

The ad-distraction cost to the users comes in various flavors, some of them are not even removable by current ad-blockers [1][13], e.g., a publisher may segment an article into many web-pages so that the number of advertisements shown can be increased. Contrast this experience to a Wikipedia page. Similarly sometimes a commercial blog, such as ZDnet, shows only one user comment on a page, in order to maximize the number of advertisement spots. Similarly pogo.com is an online gaming website, which takes a break of 30 seconds to show an ad to a user. Even if a user

blocks the ads, the games are interrupted for 30 seconds, which due to ad-blocker results in a blank window for 30 seconds.

In order to understand the distraction cost of ads to the users, Microsoft sponsored an extensive user survey conducted by a third party. We discuss some of the findings of the survey in the next section. The survey provided some of the user pain points with the ads. Motivated by the survey, the authors of this paper, all in the Microsoft Research division, conducted a small user study to start quantifying the ad distraction cost to the users. The user study is the primary focus of this paper and explained in detail in the latter sections. We believe this study is only a starting point and the broader research community would be interested in exploring some of these questions further.

2. RELATED WORKS

There are two ways for display ads to generate revenue from the marketers: per click and per impression. There have been various studies to increase the ad's click through rate, revenue per click/impression and brand recall/recognition by optimizing its placement, size, interactivity, and relevance (e.g. [3][13][17]).

Despite the all effort, click through rate (CTR) of display ads has been decreasing since its inception. According to Nielsen [16], CTR has decreased from 2% in 1995 to 0.5% in 1998. According to a report by DoubleClick [3], the static image ad CTR has dropped to 0.1% in 2008.

Another way that the display ads can generate revenue is on a per impression basis. However, users appear to have developed "banner blindness" to the displayed ads [4]. The implication of banner blindness is lower brand recall and recognition, hence lower price per impression that the marketers are willing to pay. Pagendarm and Schaumburg [19] showed that the users' navigation style has an effect on banner blindness: when users are searching for specific information or have a direct goal, they tend to ignore banners more than when they browse pages. Yesilada et al [22] speculates that 'Banner Blindness' is due to the visual grouping effect that banner creates.

Even though display ads are becoming less effective, they still experience continuous growth. According to a recent Interactive Advertising Bureau report [10], display ad market is $7.6 billion in 2008 (8% more than in 2007 and with 5 consecutive years of growth). Its share in the overall internet ad market is holding steady at 33%. This paradox indicates the number of impressions shown to the users is growing at an even higher pace. As more and more ads are shown to the users, how does that affect the users? What is the users' opinion of display ads? How much time is wasted due to displaying ads to the users? This is the focus of our study.

There were many previous studies on the negative impact of different types of display ads. For example, studies found that animation ads [24][25] and flashing ads [5] grabbed unwanted users' attention and generated negative attitude from the users. Popup ads are reported to have strong impact to users' opinion of the site and brand [5][8]. The results of these studies are in agreement with our own survey (described below).

3. SUMMARY OF USER SURVEY

Oliver and Wyman is a consultancy company specializing in user research [19]. On Microsoft sponsorship, they solicited feedback from more than 1500 users on a survey of 20 to 30 minutes. Out of 1500 survey sheets, about 1000 are used for the analysis based on the overall quality of the survey sheets. Users whose responses did not look sincere were ignored. Overall the 1000 or so survey takers who were left broadly represented the general population, as the responses to many profile questions had the same distribution as broadly known, e.g., gender, age, income, default browser, top websites visited, etc.

The survey mostly consisted of a 7 point multiple choice exercises, with the right, left, and the middle choices labeled, e.g., to a question about their pain for the ads, the left was labeled as "not painful", the middle choice was labeled as, "moderately painful", and the right choice was labeled as "highly painful". The goal of the survey was to understand the user opinion about the internet advertising.

On a 7 point Likert scale, internet ads were described moderately painful by the users, though the score was not uniform by the type of ads. Ads like pop-up ads, video-ads, and the ad within a box embedded in between an article text are described as highly painful. It is worth noting that, all these forms of ads block user's primary task, thereby taking a user's time away in a visible manner.

The other forms of ads studied, such as banner ads on the top, or text ads, or the ad within a box outside of an article text are considered moderately painful. Note that these forms of ads do not block the user's primary task, and the users could conceivable believe that they could ignore such ads. This required further focused study as described in the next section.

The next choice exercise users answered was about their ad-distraction pain on various different types of websites. The score here was quite uniform. The users were asked to describe their pain on 11 different types of websites, and on all of them they described the ads to be more than moderately painful. The eleven categories were portals, news sites, sports sites, blogs, movie/tv series sites, music sites, user generated video sites, gaming sites, ecommerce sites, and information sites. Here also the score were highest for those sites where the ads block the user's primary task, e.g., Hulu.com would show a video ad which will block a user from watching the desired video, or Pogo.com would block the game play for the duration of the ads.

The next choice exercise asked the users to choose their reasons for describing the ads painful. The top reasons, which both had a tie, were ads slow down the loading of a website and the ads are in the way of consuming the content. Each of these reasons was chosen by 50% more users than the next reason which is that they are not interested in the ads and sometimes even get offended by the advertising message.

These answers to the questions hinted us that whenever the users are aware of the time wasted by the ads, or feel that their experience of consuming the content on a website is hindered by the ads they tend to explicitly dislike the ads. The question we further studied is whether the users also feel the pain of indirect impact of ads on their experience or time waste?

One of the indirect effects of the ads is the cluttered pages and suboptimal (from a user's perspective) website design, which could potentially affect the navigational task of a user on a website. So the survey explored this possibility by asking various questions about the website design and navigation.

The scores in this category were a bit worse. Users described that finding information on cluttered pages is close to highly painful.

Figure 1: User study interface: The left pane shows the web page with ads blocked by Firefox AdBlocker Plus Add-on whereas the right pane shows the web page with ads intact. Half of the users see the interface on the left while the other half see the interface on the right.

They also described the pain of clicking multiple times within a same content as more than moderately painful.

The survey raised the question of quantifying the effect of the ads which makes a website clutter or otherwise make the task of navigation harder. A 30 second video ad is perceived by the user as blocking, and one can quantify the amount of blocking as 30 seconds time wasted (plus a few more seconds for video buffering). Consider a cluttered webpage with primary positions being occupied by the ads such as a banner ad on top and a boxed ad on the side. Since the effect of the ads on user's productivity is indirect, it is not straightforward to quantify the effect of these ads.

One way to quantify this loss of productivity is to redesign a set of common websites, by keeping the user experience in mind. In one version, the website is completely optimized for the users. In another version, a regular version is taken which is optimized for both the advertisers and the users. One could then study two groups of users on these websites.

Since re-designing websites is an extensive task, we used an ad-blocker on the user study we did [1]. The results of the study turned out to be highly consistent with the survey. The results are also consistent with other A/B tests practitioners routinely do, such as a cluttering a web page decreases the click through rate of the links on the page.

4. USABILITY STUDY
4.1 Method
We ran a web-based user study to evaluate the influence of advertising on users' ability to search through web content for answers to simple questions about the web page they were viewing. We chose 12 different, but popular, news and technology websites, roughly balanced for length, types and numbers of ads and load times. To be sure that no particular design element was unduly influencing our participants' ability to

Table 1: List of questions and the web pages that we ask the users to visit to find the answers.

#	Question
1	What is the first job listed on The Crunchboard? http://www.mobilecrunch.com/
2	What is the current temperature in Redmond, WA? http://www.weather.com/weather/local/USWA0367?lswe=Redmond,WA&lwsa=WeatherLocalUndeclared&from=searchbox_typeahead
3	What is the Dow Jones Industrial average (^DJI) today? http://www.liveside.net/
4	What is the first "Top Rated" story? http://blogs.zdnet.com/microsoft
5	What was the most popular story from SCIENCE/ENVIRONMENT yesterday? http://news.bbc.co.uk/2/hi/science/nature/default.stm
6	What is the current special report? http://www.bbc.co.uk/
7	What is the median King County condo price? http://seattletimes.nwsource.com/html/businesstechnology/2009605109_webhomesales05.html
8	What's the temperature today in LA? http://www.latimes.com/
9	What was Lyn Larsen's nickname? http://content.cricinfo.com/magazine/content/story/394444.html
10	Which bowler has taken the most wickets in Tests away from home? http://www.cricinfo.com/magazine/content/story/408022.html
11	Who is the democratic senator from west Virginia? http://news.yahoo.com/s/ap/20090805/ap_on_go_pr_wh/us_obama_health_care_overhaul
12	What airport did the reporters land in after their rescue? http://www.msnbc.msn.com/id/32294577/ns/world_news-asiapacific/

find the answers to our questions on the pages, we included various aspects about each page's design as a covariate in the study (more on this below).

We recruited 28 participants through an email solicitation to help us with web page design research. We did not disclose to these participants that we were studying the influence of ads on their ability to find answers to questions about the web pages.

A prototype environment was designed to run the study (see Figure 1). A software frame was put in place around the Firefox web browser, giving the user initial instructions about the study procedures and approximately how long it would take to complete the 12 tasks. Users had to select a button to begin the first task. Search times were begun after the user initiated the "Start" button, but page load times were noted by the system and removed from the overall search times for each task. Users were instructed to read the question at the top of the web page (part of the frame around FireFox) and to search the page for the answer as efficiently as possible. They were asked to type the answers into the text box following the task. Once they entered their response, a new web page and question was presented. We varied where the answers to our questions were, ensuring that answers occurred equally often near the top, middle and bottom of the pages. The complete list of questions and the web pages that we ask the users to visit to find the answers is listed in Table 1. The entire 12 pages and questions took approximately 20 minutes to complete.

For one half of the users, FireFox's AdBlocker Plus Add-on was turned on. In other words, theses users saw no ads while searching for the answers to their questions. The other half of the participants saw the ads just as the web page served them. We call the time between when the web page starts loading for each question and when the user clicks the submit button *Task Completion Time*. Our hypothesis was that having ads present would significantly increase the task completion time and the ability to find the answer to our questions.

Once users had completed all 12 of the web page tasks, we thanked them and asked them for their email alias. Participants received $10 gift cards for their participation. We also offered a chance for 3 participants to win $100 as a raffle. 3 users were randomly chosen to win the $100.

4.2 Results

As stated above, we tracked the task completion time and page load time for each user (see Figure 2 and Table 2).

We also collected a variety of statistics about each of the pages:

1. The number of words in the article;
2. The number of words occurring before the answer;
3. The number of lines needing to be scanned before the answer;
4. The number of pictures in the article;
5. The number of pictures before the answer;
6. The number of ads on the page (ad condition);
7. The number of ads occurring before the answer (ad condition).

These variables were included in a 2 (ad v. no ad) x 12 (web page searched) repeated measures analysis of variance (ANOVA) of the reading times as covariates to the analysis. Only one covariate,
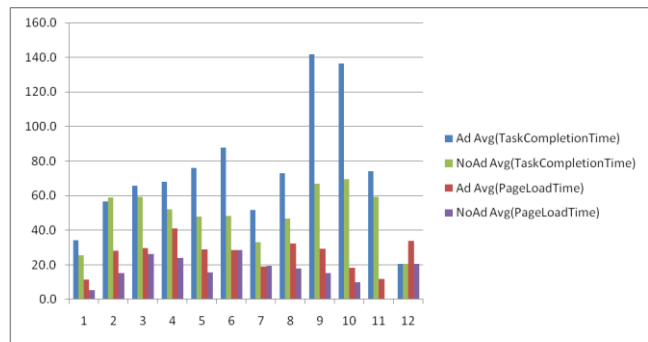

Figure 2: Average task completion time and page load time (in seconds) for each question.

Table 2: Task completion time and page load time statistics.

	Task Completion Time (in sec)				Page Load Time (in sec)			
	Ad		No Ad		Ad		No Ad	
Ques.	Avg	Stdev	Avg	Stdev	Avg	Stdev	Avg	Stdev
1	34.4	13.8	25.5	17.3	11.3	4.9	5.2	1.9
2	56.8	24.5	58.9	40.3	28.1	10.6	15.4	11.4
3	65.6	26.2	59.2	35.3	29.5	14.9	26.1	10.6
4	67.9	40.6	52.0	19.6	41.0	19.2	23.9	12.1
5	76.0	80.3	48.1	39.6	28.9	17.1	15.7	8.5
6	87.7	148.2	48.3	19.2	28.4	21.5	28.4	20.6
7	51.6	25.2	33.1	15.2	18.9	14.4	19.3	20.2
8	73.2	71.8	46.9	24.6	32.4	16.6	18.0	14.3
9	141.9	81.0	67.0	35.7	29.3	15.4	15.1	9.7
10	136.3	222.8	69.5	67.5	18.1	17.3	9.7	12.6
11	74.0	54.0	59.4	33.7	11.6	19.9	0.4	1.0
12	20.7	7.3	20.7	6.0	33.8	23.4	20.7	36.3

number of pictures on the web page, had a significant effect on the data, $F_{(11, 154)}=2.98$, $p=0.001$, meaning that it slowed down reading times when more were present. There was also a significant effect of having ads present, and this dramatically slowed down task completion times, $F_{(1, 14)}=6.04$, $p=0.028$. Having ads present on web pages increased users' task completion times by more than 50% (74.8 seconds on average with ads, versus 48.2 seconds on average without ads). This means that each web page view with ad slows down the user by 27 seconds on average. We had hypothesized we would see a difference, but were surprised to see how big it was! It would appear from our data that any visual distraction, whether pictures or ads, can slow readers down.

5. DISCUSSION AND CONCLUSION

The study gives some preliminary evidence that there is a significant cost of advertising to the users in terms of the distraction cost. In some cases the users are already self aware of these costs, as the survey shows. In some cases the users feel this cost indirectly and could become self aware of this cost if the web could offer a better user experience.

This study shows that the currently the user experience and the business model offered by the web are not in harmony. A vast majority of web pages make less than 0.1 cent per page view [10]. If the advertisement slows down a reader by 27 seconds, in terms of longer page load time and slower reading/navigation, then it means that the people time is valued at 13 cents an hour. In other words, for every hour given to ads a website is providing only as much content which in principle could be supported by 13 cents payment. It is known that user's marginal value of time is much lower than the average value of time, but we suspect it is as low as 13 cents an hour.

Note that in our study we did not get the full negative effect of the ads. All our participants had a corporate quality broadband, which is far better than the general audience would have. Our user-optimized version of a website was generated by simply applying an ad-blocker software. One could in fact completely redesign a website in user's favor to understand the total cost of the display ads. As an example, read the New York Times either on their website or via a special reader software, called New York Times reader [17]. If in a year a user views 1000 articles on New York Times reader, it is perceivable that the gain in user experience would be more than a few dollars, which the New York Times might be making via ads. Due to other economics consideration beyond the discussion of this paper, this software is not available at $1 a year subscription but requires $180 a year subscription making it useful only to those folks who reads New York Times a lot and/or have a very high value of their time [18].

In conclusion, our paper raises a question of designing a new or improving the current user experience and business model of the web, which takes directly into account the negative externality of ads on the users. This is already somewhat done in the case of search ads, and indeed the search ad is the healthiest of form of advertising on the internet [11]. An ideal combination of a user experience and business model of the web will have the property that a website publisher is making more money than the cost of the additional user's time wasted by the presence of the ads. This may require not only making the advertising more relevant and pleasant to the users, but may also require constraining the number of advertising spots available on the internet. Most of the current focus of the industry is on behavioral ad targeting [22], which may make the ads more relevant. An ad which is considered useful by a user may not be considered as time waste. Behavioral ad targeting also has another negative externality on users in terms of their privacy concerns. Behavioral targeting may be necessary but may not be sufficient, in case the ads do not become more pleasant and their numbers are reduced too.

6. ACKNOWLEDGMENTS

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