Digital Advertising’s Human Toll:
How Implied Cost-to-User Affects Web Content Platforms
(A Research Proposal)

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Abstract
Online advertising is a $26 billion industry in the US. While this represents significant income for Web sites hosting such ads, sites need to balance the income against the needs of their audience. Inasmuch as advertisements dissuade users from returning to a site and cause delays and decreases in task performance, their presence extracts a “cost” from users. This proposal discusses exploring drivers of this cost through a laboratory experiment in which subjects navigate a purpose-built Web site in order to complete a task all the while being subjected to a given advertising treatment.

1. Introduction
Since the dot-com slump in the early 2000s, online advertising has rebounded to become an important marketing vehicle. US online advertising sales accounted for more than $26 billion in revenue in 2010, more than double the figure from 2005 and behind only television among advertising channels [13]. Of the 20 most-trafficked US Web sites (per Google’s DoubleClick Ad Planner tool), 15 generate revenue through third-party advertising. This increase in online advertising has been of particular importance to publishers of “free content”, such as news sites, online magazines, and premium bloggers. However, while advertising sales are large and sites both major and minor rely on them for revenue, relatively little is known about the impact display advertisements have on the size of a Web site’s user audience.

From a Web site publisher’s perspective, display advertising should follow a Laffer curve. A site that hosts no advertising generates no advertising revenue, but a site that consists only of advertising should also generate no advertising revenue since there would be no incentive for users to visit such a site. The optimal amount of advertising, then, must be some point in-between; additional advertisements beyond this point begin to inflict enough of a “cost” to users that the audience shrinks more than the amount for which revenue from an additional ad unit can compensate.

Given this effect, in order to optimize the amount of advertising space offered, a Web site publisher needs to understand the “cost” that a user incurs through exposure to a page’s advertisements. The proposed research would address this need by conducting a controlled experiment to address key questions related to this cost-to-user: What are the components of cost-to-user in the online advertising context? How might it be quantified? What are its drivers? What factors can mitigate this cost? Through an understanding of these questions, Web site publishers and digital advertising platforms should be able to more optimally balance the nature and quantity of published advertising against the need to attract and retain users.

2. Background
In a basic sense, advertising-supported Web sites function the same way that other advertising-supported media (e.g., television, radio, magazines, newspapers) operate: the Web site provides content that attracts visitors, then monetizes these visits by selling advertising space to advertisers. This is a form of two-sided optimal tax rate at which the greatest amount of revenue may be generated. Any additional tax beyond this rate would result in negative marginal returns since it begins to too-severely disinsentivize producers from generating additional revenue.

3 The term “laffer curve”, coined by Wanniski [24], typically refers to taxation. In particular, it suggests that there is an
market, a term used to designate markets where a platform enables two sides to interact that would not have otherwise been able to do so. Such markets are characterized by the existence of “cross-side network effects”, whereby additional agents on one side of the platform impact the desirability of the platform for the other side [3, 7, 21]. In the most commonly discussed cases of two-sided markets, such as video game consoles (which connect game studios with gamers), mobile operating systems (application developers and users), and online auction sites (sellers and buyers), the cross-side externalities are positive: the more agents there are on Side A, the more attractive the platform is to Side B and vice versa. In online advertising, as with other advertising media, while a greater number of users makes the platform more attractive for advertisers, a greater number of advertisers makes the platform less attractive for users. In other words, there is a negative cross-side externality.

In any two-sided market, it is up to the platform at its center to determine a pricing structure and mechanism that attracts the optimal number of participants on each side of the market [3, 7, 11, 14, 15, 21]. Given that the “price” being charged from site users comes via exposure to advertisements, then, it is important for owners of these sites to understand what that price is and how it can be measured, manipulated, and optimized.

But what is the “cost” users are paying in this context? (Or, asked otherwise, what is the “price” being charged?). Clearly, it is not monetary: Web site users do not pay money as the (direct) result of being exposed to an advertisement. Cost, however, can be viewed in terms of the attractiveness of a good or service. Basic economics explains that the more a product costs, the less it is in demand. Without monetary pricing, then, we should be able to infer the cost of a good by its desirability, i.e., given two Web sites that are the same except in their approach to display of any advertising, the one of the two deemed less desirable is the one that must extract the higher “cost” (and must therefore have the higher “price”).

While not necessarily focused on such cost, the effects of advertising on consumers have been studied for decades, especially within “traditional media” (e.g., television and radio). These studies have generally been conducted to understand the feelings of consumers toward the advertiser and not their feelings toward the content medium. For example, such research has found that “intrusiveness” is a major contributor to irritation and annoyance for consumers [4]. In the radio context, advertisements that cause these irritations have been found to correlate with viewers avoiding or ignoring those advertisements [2]. Further, Aaker and Bruzzone (1985) found that irritation from televisions advertisements varies significantly based on viewer demographics, the nature of the product being advertised, content-related factors (e.g., the tone of the advertisement), and qualities related to ad execution [1]. Still, while these studies note that this annoyance can have a negative impact on the advertisement, does this annoyance transfer to the host medium as well? Do annoying advertisements cause radio listeners to abandon the radio stations that host them? Do they raise the cost?

Other researchers have considered such questions. Previous research, for instance, has found that among New Zealand television audiences, advertisements reduce audience size by 15% during a given commercial break [9]. A more recent study looked at cost-to-user in the television context through the lens of the two-sided market. In it, a model was constructed that predicted that, assuming no response from competitors, a 10% decrease in a network’s advertising time would result in a 25% increase in that network’s viewership [23]. Both studies make clear the potential problem facing owners of advertising-supported media, however neither track attributes of the advertisements or consumers to understand which aspects drive cost-to-user.

Similar to studies of advertising in traditional media, studies of online media advertisements have also focused primarily on the advertisements’ effectiveness (e.g., through measuring resultant advertisement recall and brand affinity) rather than on the user-Web site relationship. A number of studies have found that, similar to traditional media consumers, Web users consider display advertisements annoying [16, 19, 20]. Research has also found that the format of an advertisement (e.g., whether it was a “pop-up ad”, banner advertisement, etc.) had an impact on the user response to the advertisement itself [6] and that, using self-reported measures, perceptions of “goal impediment” and “advertising clutter” led users to avoid particular online advertisements [8].

Looking at issues more similar to cost-to-user, it has been found that the presence of
advertisements on a Web site can decrease the site’s credibility [10], which seems a reasonable precursor to a decrease in site visitation. Studies by McCoy et al. (2007, 2008) have found through experimentation that “intrusiveness”, “irritation”, and “attitude toward site” worked as serially mediating factors that impacted the user’s self-reported likelihood of returning to a site [17] and that familiarity with a Web site affected perceptions of site quality in the presence of pop-up advertising [18].

In addition to cost inferred from the desirability of visiting a site, two other potential cost factors emerge from the Web-specific literature: delay and task performance. It has been proposed that Web users are more task-focused than are consumers of traditional media [25]. For such users, delay and effectiveness of task completion are considerable factors and, as such, past research has explored related issues. It has been found, for instance, that advertising banners that “flash” increase a user’s “workload” and that the presence of advertisements decreases visual search speed [5]. Other research found that general computer task performance was negatively impacted when users were subject to on-screen elements with animation, bright colors, and content similar to the task content [24].

But while studies related to the proposed research have been conducted both in traditional media and online contexts, there remains a substantial need for additional research into cost-to-user in online advertising. While television advertising has obvious similarities to online advertising (e.g., both television and the Web are visual media and both can host advertisements with audio-visual content) and should certainly inform any online advertising research, there are material differences between the two environments that necessitate separate consideration of online practices. For instance, the presentation of advertisements is different between the two media; television commercials play during breaks that interrupt the viewer-chosen content, while online display advertisements can take a number of forms, sometimes interrupting the user directly (e.g., pop-up ads and “interstitials”) and other times seeking to distract the user indirectly (e.g., video advertisements placed to the side of the Web page). While television viewers can avoid viewing advertisements by time-shifting via digital video recorder (DVR), changing the channel, or simply leaving the room, Internet users have not generally adopted mechanisms to do the same and are therefore unable to avoid exposure. Further, user intent between the two media seems markedly different: television viewers are primarily entertainment focused, while Internet users are seemingly more task-focused and information-seeking.

Important research has been done in the online environment and the proposed study aims to build on this research. The impact of annoyance drivers identified by Aaker and Bruzzone (1985) have not been fully explored in the online advertisement context. The proposed research would, in particular, examine the impact of entertainment value, advertisement execution quality, and advertisement relevance to the site among these. In addition, this study would look at the impact of the quantity of Web page “real estate” devoted to advertising, another heretofore unexplored driver. Further, while previous papers have looked at objective and subjective dependent variable measures in isolation and, similarly, looked at demand-oriented and task-oriented costs in isolation, this research would look at these together. This combination should allow for a more nuanced understanding of cost-to-user than would otherwise be possible.

3. Model and Hypotheses

In order to better infer causality between drivers and cost-to-user, data will be collected in a controlled laboratory experiment (see §4).

This proposal suggests a combination of objective and subjective measures as dependent variables. Objective measures will be collected through an experimental task. In the task, subjects will be asked to complete a set of information-gathering objectives on a purpose-built content Web site. Subjects will be scored both in terms of accuracy and time to complete tasks. Subjective measures will be collected from subjects in a post-task survey and will include multi-item measures of intent to return and attitude toward the site. Objective measures are expected to more closely resemble task-related cost, while the subjective measures are expected to more closely express the user’s perceived cost

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2 Plug-ins written for modern Internet browsers (e.g., Firefox) can effectively block most online display advertising from displaying, however anecdotal evidence (e.g., [http://www.quora.com/What-is-the-percentage-of-Internet-users-that-employ-AdBlock-Plus-or-similar-ad-blocking-plugins](http://www.quora.com/What-is-the-percentage-of-Internet-users-that-employ-AdBlock-Plus-or-similar-ad-blocking-plugins)) suggests that the vast majority of users have not installed such plug-ins.
and, thus, reduced likelihood to return to the Web site. The expectation is that these two forms of cost are distinct from one another and, thus, that these two measures will not be significantly correlated.

**Hypothesis 1:** Objective and subjective measures of cost-to-user will not be significantly correlated with one another.

There will be two categories of independent variables: individual-level and advertisement-level.

### 3.1. Individual-Level Variables

Individual-level variables will include demographic variables (gender, age, nationality, ethnicity) and other individual characteristics (entertainment drive, technology savvy, purpose-of-Internet perception). While the demographic variables will be included ostensibly as control variables, it is worth noting that Aaker and Bruzzone (1985) found such variables to be significant predictors of ad annoyance. From an advertising perspective, these factors may be particularly interesting drivers of cost given the demographic targeting used in many advertising campaigns. With regard to the other individual-level variables:

- **Technology Savvy:** Users who are more technologically savvy (i.e., they have more and higher-level computer skills such as using blogging software, coding software programs, developing complex electronic spreadsheets, etc.) may interact with the Internet differently from other users. Those individuals with more technology savvy should incur lower costs because these users are expected to be more adept at ignoring advertising and, thus, should be less affected by it.

**Hypothesis 2:** Individuals with higher levels of technology savvy will incur less cost.

- **Purpose-of-Internet Perception:** Zhang (2008) suggests there may be a difference between perception of TV advertisements and Web advertisements stemming from the perceived purpose of the medium. TV is generally considered to be an entertainment medium, while the Internet is considered more as an information tool, i.e., something that helps a person accomplish an information task. Here, it is expected that users who perceive the Internet more as a tool will incur a higher cost due to advertising than those who perceive it more as entertainment since advertising does not interfere with information gathered in other information-related tools (e.g., text books).

**Hypothesis 3:** Individuals who perceive the Internet more as a tool than as an entertainment medium will incur greater cost.

### 3.2. Advertisement-Level Variables

Given the expectation of using analysis of variance to compare results, the experiment will need to restrict the number of advertisement-level variables. For instance, even with the experiment restricted to four dichotomous advertisement-level variables as suggested here, this still results in a 2x2x2x2 factorial design (= 16 cells), which will require a substantial number of test subjects. Advertisement-level variables were selected based on factors identified by Aaker and Bruzzone (1985) and include:

- **Entertainment Value:** By entertainment value, we refer to the extent to which the advertisement is generally found to be entertaining. The entertainment value of the advertisements in this study will be determined by conducting a survey of consumers (see §4). It has been found that more entertaining advertisements are considered less annoying in the offline context [1] and our expectation is that this will also be true in the online context in terms of the subjective measures; we expect, however, that an entertaining advertisement might not have this impact on objective measures since it may be more distracting to users. We also expect to see an interaction effect between entertainment value and the individual’s entertainment drive vis-à-vis subjective cost measures.

**Hypothesis 4a:** Advertisements with higher entertainment value ratings extract a lower subjective cost from users based on subjective...
Hypothesis 4b: Entertainment value and individuals’ entertainment drive interact such that those with high entertainment drive will incur a significantly lower subjective cost in the presence of an advertisement with high entertainment value than those with low entertainment drive.

Execution Quality: Aaker and Bruzzone (1985) found that, in given situations, an audience’s perception of qualities regarding the advertisement’s execution correlated with the level of annoyance felt toward TV advertising [1]. In their paper, advertisement execution items measured qualitative ideas such as phoniness, informativeness, liveliness, and overall appeal of an advertisement. Given the diversity of advertisements in the Internet sphere, this seems a worthwhile driver to test in the online context and we expect to see significant findings such as were found in the television context.

As such, we expect that advertisements that generate more positive perceptions of execution quality will lead to lower cost-to-user according to subjective cost measures. However, since such ads should be more effective in attracting users’ attention (and thus distracting users from their task) there is no expectation of decreased cost for objective measures.

Hypothesis 5: More positive perceptions of execution quality are associated with lower cost based on subjective measures.

Relevance to Site: The “relevance to site” construct considers the match between the content of the advertisement and the content of the site. As noted above, past research found that a match between non-task content and task-related content resulted in lower task performance [24]. The referenced research, however, collected its data through an experiment that made use of a generic computer-based environment rather than one that attempted to closely resemble a commercial Web site. As such it will be worthwhile to reconsider this variable in a more realistic experimental environment.

Hypothesis 6: Advertisements considered more relevant to the site will extract less cost from users.

Advertisement Density: Advertisement density refers to the amount of on-screen “real estate” occupied relative to the content component of the page. Past research has supported assertions that the presence of banner ads increases a Web user’s work load [5] and that overall visual complexity on a Web page may be implicitly linked with cognitive complexity [12]. Extending this concept, we hypothesize that the more area an advertisement occupies, the more likely it is to distract the user and increase the workload the user must handle, thus extracting a higher cost.

Hypothesis 7: The more real estate occupied by advertising relative to site content, the higher the cost to the user.

The hypothesized relationships above are depicted in the model in Figure 1.

Figure 1. Hypothetical model

4. Approach

Data will be collected through a laboratory-based experiment using student subjects. The experiment will be carried out in two stages with each stage collecting a portion of the required data.

4.1. Stage One Experiment

In the first stage, ad units will be assessed on the subjective ad-level IVs (entertainment value, execution quality, relevance to site). Subjects will be shown a series of advertisements within a
Web site context and asked to rate these against items reflective of each of the constructs. Responses will be collected and evaluated in order to assign values to the individual ad units for the corresponding IVs. These ratings will then be used in the analysis of the second-stage experiment.

### 4.2. Stage Two Experiment

In the second stage, a second set of subjects will be asked to perform an information-gathering task on a purpose-built Web site. The Web site will be designed to simulate a news or entertainment content Web site with intra-site links to articles containing text and other article-related content (e.g., relevant photographs).

Subjects will be told that they will be evaluated on the accuracy and completeness of their completed task; a cash prize will be offered in a random drawing from individuals with the highest accuracy and completeness scores. During the course of their task, subjects will be exposed to online advertisements corresponding to treatment groups made up of the identified ad attribute variables. Each subject will receive only ads from one treatment group and there will be only one ad type per treatment group.

Immediately following completion of the task, subjects will be surveyed. Through the survey, subjects will generate scores for the subjective dependent variables (intent to return to site, attitude toward site) as well as individual-level independent variables (demographic information, technology savvy, purpose of Internet perception, entertainment drive).

### 4.3. Data Analysis

Once data are collected, variables will be subjected to factor analysis to verify item loadings on constructs. Data will then be analyzed via ANOVA. Contrasts will also be considered in order to suggest possible relative values between the attributes (e.g., that large advertisements are x-times as costly as small advertisements). Depending on findings of the ANOVA analysis (e.g., whether it appears there may be second-level constructs present), PLS Graph will also be used in order to define any such constructs and their related relationships. Further, mediation effects will be tested using the approach discussed by Zhao et al. (2010) [26]. Finally, the difference between subjective and objective dependent variable results will be tested for significance.

### 5. Expected Findings and Possible Implications

Through this analysis, it is expected that several important outcomes will be realized. First, relationships between individual and treatment drivers and cost should be identified, thus identifying significant components of cost-to-user in the online advertising context as well as indicating factors that may mitigate this cost. Further, this study should enable a better understanding of the relative cost among different drivers (e.g., Driver A impacts cost twice as much as Driver B). Significant findings would indicate to practitioners which ads “cost” more and by how much. This would give Web site publishers a basis by which to consider both variable ad pricing based on the tested ad and audience characteristics and potential options for optimization of ad inventory allocations by page. Should factors such as entertainment value and production quality be found to significantly correlate with lower cost, it may be worthwhile for site publishers to consider offering discounts to advertisers whose ads result in lower cost-to-user [23].

The research would also enable a comparison between a user’s subjective assessment of “perceived cost” and a user’s objective scores that measure the “actual cost.” Convergence between these two measure types would more strongly imply that an meaningful and consistent “cost” is being understood; i.e., agreement between the two types should lead one to more confidently expect that so-measured costs correlate with a user’s probability of returning to a given site for information. A significant difference between these two measure types may indicate a need for further research to understand the source of the difference as well as to ascertain which of the two measure types better predicts which users will actually return to a site.

Significant findings should also foster further research, both in experimental and real-world settings. The selected variables could be further broken down to determine a more granular source of significance, e.g., if ad density is significant, is there a linear relationship between percentage of real estate devoted to advertising and cost? Does the real estate location matter? How do an advertisement’s
attributes interact with the perceived quality of the Web site that hosts it? Significant experimental findings could also be used as the basis of empirical real-world research to determine whether, in fact, user traffic patterns are impacted by sites’ advertising hosting strategies as predicted.

6. Conclusion

The proposed research fills a gap in the current knowledge regarding online advertising. The results would further the development of theory regarding such ads and enable other researchers to investigate additional relevant issues with sharper focus.

7. References


