Modeling the Effect of Habituation on Banner Blindness as a Function of Repetition and Search Type: Gap analysis for future work

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Abstract

This paper provides a theoretical foundation to guide future work in online marketing research. Specifically, we target the phenomenon of banner blindness that prevents users from noticing online advertisements; thus, leading to a steady decline in revenues for online publishers and service providers.

While habituation was identified as the main cause of banner blindness, there are competing behavioral models that predict different orienting response patterns as a function of repetition. This work bridges the theoretical gap between models in the marketing and ergonomics domains while illuminating an additional factor that has yet to be studied in this context – search type. Finally, we outline future research steps to validate the user's response to online advertisements with an emphasis on a battery of physiological measurements.

Keywords
Habituation, User Models, Banner Blindness, Goal-Driven Search, Exploratory Search, Online Marketing.

ACM Classification Keywords
H.1.2 User/Machine Systems: Human Factors
H.5.2 User Interfaces: Screen design (e.g., text, graphics, color)

General Terms
Design, Experimentation, Human Factors, Performance, Theory.

Introduction

On October 27th, 1994, a new form of marketing tool was born that would revolutionize business and publishing. It was a novel online magazine called HotWired (known today as Wired Magazine) that introduced a banner ad by AT&T [26,7]. To measure the effectiveness of the banner, advertisers use a click-through rate (CTR) that indicates the ratio between the number of page visits and the number of times that the banner was clicked. While the CTR for the first banner was an astonishing 78%, the CTR has been steadily declining to an average of 2% despite improvements in ad relevancy to online content and increased sophistication in user demographics data mining [10]. This drastic decline led some publishers to conclude that the prevalent model of free content paid by ads is unsustainable [6].

Previous studies found that the cause for the CTR decline lies in repeated exposure to the banners that leads to banner blindness [2,5]. One potential cause for banner blindness is habituation, which is defined as "… response decrement occurring as a result of repeated or continuous stimulation…" (p. 3) [11]. Since the perceived information is already represented in the memory storage, the stimulus is not salient, which in turn prevents the user from orienting their response to that stimulus [18]. Consequently, users are simply ignoring ads because they do not capture their attention [9]. This led publishers to pursue more invasive ads using animation to utilize attention capture that is caused by movement [21]. However, a number of studies found that the use of animation does not affect banner blindness nor increase brand recall [1,4]. Therefore, the challenge of the present study is to better understand the process of habituation, which will allow us to develop effective counter measures.

Previous studies

Similar to the issue of banner blindness in the online environment, studies in the ergonomics domain investigated how habituation affects perception and compliance to hazard labels. One of the earliest studies in this domain found that users gradually became less compliant with a warning signal over time, thus, demonstrating habituation [19]. In their experiment, the researches posted a warning sign on one of two doors, asking the students to use the other door instead. With time, the students began to ignore the warning sign and used the "defected" door to exit the class room. Contrary to their initial hypothesis, changing the sign appearance did not reverse the habituation effect as the students' compliance rate continued to decrease. The authors argued that social influence may have confounded their results.

In a follow-up study [20], the authors presented the participants a series of pictorial and text warnings followed by another set with different warnings. Using

galvanic skin response measurement, the authors were able to record the habituation progress expressed by a decrease in orientating response. When a new set of stimuli was presented, the results showed a significant dishabutuation effect, represented via an increase in the participants orienting response. However, the response in the following trials (using the new stimuli) was sharply reduced to the pre-testing condition.

These results coincide with other studies that found that a change in the warning appearance may disrupt the habituation process and increase the likelihood that the users will respond accordingly [23,22,24].

Conflicting findings

Contrary to the previous findings, research in the marketing research domain suggests that habituation plays a *positive* role in the users' response. The habituation-tedium theory [3,17,16] argues that a response to a new ad is based on an interaction between habituation and tedium. Novel stimuli will result in a low orienting response because they instigate uncertainty and tension. Habituation serves a positive role in reducing the negative attitudes, resulting in more liking of the stimuli, which in turn leads to an increase in user response to the stimulus. However, with increased repetitions, boredom increases (tedium), which leads to a decrease in liking and orienting response (see figure 1).

According to this theory, habituation has the most impact in early stages of exposure and tedium is most powerful in later stages. The result is an inverse U-shape form of response to stimulus as a function of liking.

Interestingly, the findings from the ergonomics domain stand in clear contrast to the Habituation-Tedium theory predictions. As can be seen in figure 2, while the rate of habituation increases, the response to the stimuli decreases continuously as the number of repetitions increases.

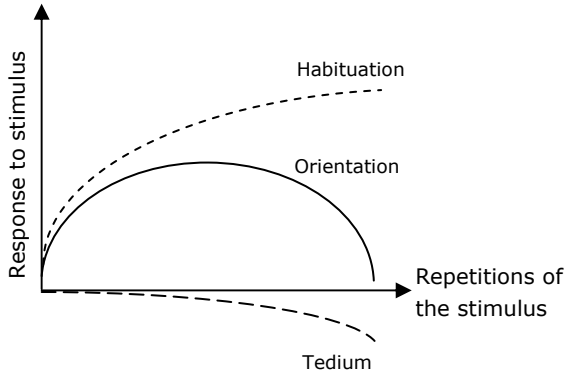

figure 1. A modified illustration of the Habituation-Tedium Theory.

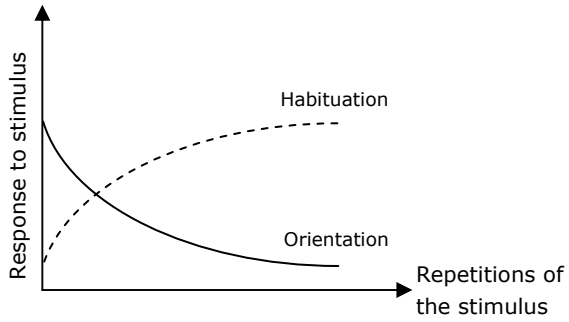

figure 2. Response model based on findings from the ergonomics domain.

While habituation research in the ergonomics domain targets compliance to hazard labels and ignores issues of appeal and boredom, studies in the marketing domain target responsiveness to a commercial ad that was designed to solicit empathy with the ad's content.

Nevertheless, these conflicting findings evoke the need to evaluate how habituation affects the response rate to banners in an online environment to allow more accurate predictions of banner blindness.

The effect of search type on habituation

Since a significant portion of online advertising targets search, it is important to investigate what effect (if any) search tasks have on habituation.

Two main types of search are goal-driven and exploratory. Goal driven search is characterized by a top-down attention process that is aimed to retrieve data based on predefined criteria [25,12]. This task is generally referred to as "lookup", where the user is searching for discrete and well defined information [15].

Exploratory search is characterized by "learning" and "investigation" tasks that aim to gather general information about a specific topic or body of knowledge [15]. The process of exploratory search requires a continuous decision-making process as the user shifts attention from one stimulus to another. During this process, the attention resources that are derived from the current focal stimuli compete with peripheral sources of information [12,15].

Due to the differences in attention processes between goal-driven and exploratory search tasks, there may be a difference in the users' susceptibility to banner blindness. Arguably, users who engage in an exploratory task are more likely to be attracted by the banners, thus inhibiting the habituation process.

The use of physiological measures in user modeling

While a variety of self report and behavior logging techniques and eye tracking methods are prevalent in human-computer interaction research, there have been limited attempts to assess online consumer behavior using physiological measures such as galvanic skin response and heart rate. These measures can detect an autonomous response within 15 to 75 milliseconds of exposure to a stimulus, which could otherwise be missed using traditional eye tracking measure [14]. While a previous study suggested that static banners and text do not elicit cardiac response [13], it is likely that a cardiac effect was not found due to the use of experienced (therefore desensitized) users. Additionally, there have not been published attempts to assess the correlations among different biometric (eye movement, heart rate, galvanic skin response) indicators of attention and habituation. Integration of these methods may become essential to find small effect sizes in user experience research.

Discussion and future work

While the phenomenon of habituation to visual stimuli has been explored in the past 50 years, there is little evidence that allows us to explain how habituation affects banner blindness. Moreover, the current models from the ergonomics and marketing domains predict different rates of orienting response. Therefore, the primary goal of our future series of studies is to examine what are the effects of stimuli repetition on banner blindness while controlling for a number of

independent variables, such as display style (layout, color, size) and ad relevancy to content, with the goal of measuring how habituation takes effect over the users' orienting responses as they progress from one search task to another. This will be done using a battery of dependant variables of physiological (eye tracking, galvanic skin response, and heart-rate), and qualitative measures (ad recognition and user satisfaction).

In addition, the effect of task type, goal-driven vs. exploratory search, on habituation has yet to be discussed in the literature. Since all search engines rely on ad revenue for financial support, we plan to examine whether search type may moderate the effect of habituation such that the rate of habituation under exploratory search tasks will be higher than goal-driven task and what could be the repercussions of such an effect on the graphical user interface guidelines.

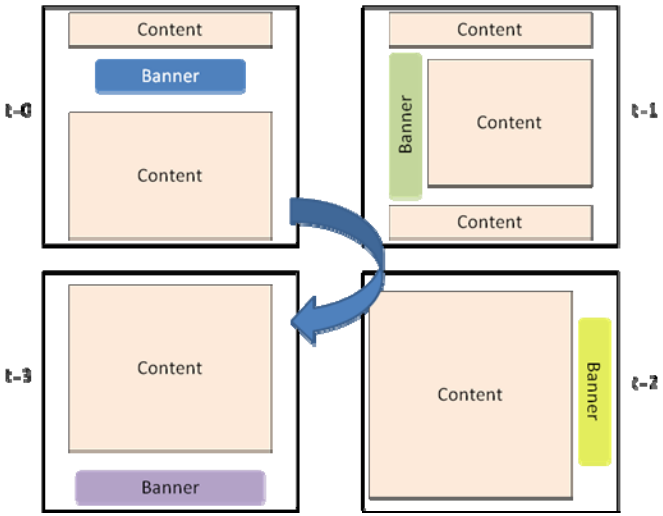

figure 3. Random iteration of the banner's size, color, and location is expected to mitigate habituation and decrease banner blindness.

The literature from the ergonomics domain suggests that iteration of the design components may inhibit the progress of habituation and increase the user's response to the stimuli. Therefore, we will also examine whether random manipulation of the display style can mitigate the banner blindness effect (see figure 3), while maintaining a positive or neutral user experience.

Lastly, we are interested to investigate broader research questions with regards to the use of physiological measures such as galvanic skin response and cardiac measures in user-experience research. Currently, the use of these measures is absent in most industry labs, which focus solely on a combination of soft experimental designs, interviews, and eye tracking. The additive benefit of physiological measures in user experience research is unknown due to the limited published research in this domain. As mentioned earlier, physiological measures can detect small effect sizes that could be vital in some operations. Therefore, we intend to investigate the correlation between eye tracking, galvanic skin response, and cardiac measures to assess whether these measures are redundant to one another or complementary. The results of these studies may have significant impact on the practice of user experience research and allow researchers to further advance their studies to find differences between parallel interfaces that currently remain hidden.

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