Increase the Effectiveness of Online Distracting Advertisement: Examining the Effects of Location-based Personalization with Eye Tracking Technology

Research-in-Progress

Xixian Peng   **Xuhong Ye***

Tingting Weng   **Hock-Hai Teo**

Abstract

Retailers often use online advertising to market their products and services. However, consumers tend to consider these advertisings as uncomfortable or irritated interruptions that distract their attention from goal-oriented activities. To increase the effectiveness of online advertising, this paper investigates the impacts of personalization on consumers' attentional engagement and responses by using eye-tracking technology. The results show that compared with non-personalized online advertising, personalized online advertising has a significantly positive impact on attention (i.e., number of fixations and fixation duration) and enhanced attentional engagement lead to higher visiting intention to the advertised merchant. Our study provides an insightful view by focusing on attentional engagement in online advertising research and offers suggestions for online retailers and advertisers.

Keywords: Personalized online advertising, Attentional engagement, Visiting intention, Eye-tracking technology

Introduction

Browsing is one of the most frequent activities online users perform on a variety of websites, including search engine, news site, blog, social media, etc. Equally frequent is the exposure of users to online advertisement. Online advertising has rapidly grown since the Internet has been affordable for ordinary users. From the retailer's perspective, online advertising can introduce various benefits. For example, online advertising can reach a nearly global market, reduce the cost of displaying online advertisements compared to offline advertising, and make the delivery of online advertising more efficient without being linked to the publisher's publication schedule (Goldfarb and Tucker 2011). Therefore, global online advertising spending has been constantly increasing since 2010 and would grow to 225.5 billion U.S. dollars by 2020 (Statista 2019). However, from a user's perspective, online advertising is a distracting factor that perturbs the browsing process that users engage in (Brajnik and Gabrielli 2010). For example, consumers view online advertising as an unwanted distraction which causes them to lose their online-surfing place and are struggling to find "close" button to get rid of a

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* Corresponding author: Xuhong Ye (E-mail address: xhye@zjut.edu.cn)

pop-up advertisement or turn to ad blocking plug-ins (Cho 2004). As a result, consumers' interests and sensitivity to advertising information are also getting lower and lower (Cho 2004). The click-through rate of online advertising is extremely low, for instance, the click-through rate of advertisements on Facebook is only 0.165% (WorldIT 2011). Therefore, how to increase the effectiveness of online advertisements is a tough challenge and still of great importance for both marketers and researchers.

Previous research has identified diverse factors that can facilitate the effectiveness of online advertising (Brajnik and Gabrielli 2010). Among them, personalization is a critical factor that has attracted great attention because the development of communication technology offers advertisers the ability to research customization and narrow market segments for targeted advertising by adapting to consumers' profiles, history, and their needs. For example, retailers can use geo-targeting to display relevant advertisements based on users' geographic information (Fong et al. 2015; Luo et al. 2014). This location-based personalization has been identified as an effective way to improve the persuasiveness of online advertisement (Fang et al. 2015; Fong et al. 2015; Luo et al. 2014). However, there is little research examining the underlying cognitive mechanism of how location-based online advertising can influence consumers' online browsing experiences. To address this research gap, this research-in-progress paper is trying to investigate the role of attentional engagement by adopting the eye-tracking technology. To test our predictions, we conduct a lab controlled experiment with multi measurements, including self-reported and eye-movement data. The results show that online users respond more favorably to the location-based advertisement and attentional engagement mediates this positive effect. Our focus on the role of attentional engagement adds an insightful view that is missing from previous literature. Given the increasing investment in the digital advertising market, our study also offers important design suggestions for online advertising designers and practitioners.

Literature Review

Personalized Online Advertising

The purpose of personalized advertising is to assign more appropriately customized advertisement to individuals. Personalized online advertising is defined as online advertising that serves to users based on consumers' identity and behavior (Aguirre et al. 2015). It is a practice of online behavioral advertising which collects data from online surfing behavior by installing 'cookies'. Using these personal profiles such as users' preferences, online habits, and historical data, retailers and advertisers can customize their advertisement contents and deliver them based on consumers' specific characteristics. Advertising personalization increases the perceived relevance of advertising message to consumers, and as a result, can significantly increase advertising effectiveness such as response rate (Heerwegh and Loosveldt 2006), customer satisfaction and purchase intention (Thongpapanl and Ashraf 2015). One important way to customize the advertising message is based on consumers' geographic information. Consumers are more likely to visit the merchants that are close to them because of lower perceived cost but higher perceived relevance (Fong et al. 2015; Luo et al. 2014).

Eye Movement and Attentional Engagement

In this study, we use the eye-tracking method to examine the possible cognitive processes under location-based personalized advertising. Thus, it is necessary to consult the eye movement literature to grasp the basic characteristics of eye movements and their corresponding cognitive perceptions.

When humans look at or search an object (e.g., a webpage), their eyes remain relatively still on *fixations* and the time length of fixations is called *duration* (Rayner 1998). Fixations are the important moments that information is extracted from the visual stimulus. Meanwhile, longer duration means that the location our eyes fix on is more informative (Loftus and Mackworth 1978). The length of duration and number of fixations are two prominent measures of attention, with longer duration and more fixations representing more attention allocated (Rayner 1998). A number of studies have adopted duration and number of fixations as implicit measurement of attention in investigating diverse topics related to visual information processing, such as advertisement persuasiveness, website information search, video perceptions, etc (Cian et al. 2014; Resnick and Albert 2014; Shi et al. 2013;

Wang et al. 2014). Attention is directed towards human perceptions and cognitions related to the immediate physical environment, and also a critical predictor of evaluations of external stimuli (Rahinel and Ahluwalia 2015). In the context of visual information processing, marketing literature defines engagement as the maintenance of ones' attention to an object, with more attention allocated indicating greater engagement with the object (e.g., Cian et al. 2014; Pieters and Wedel 2007). Ultimately, attention or feeling of engagement (here we defined these cognitive reactions to "attentional engagement") has been shown to affect persuasion and attitude positively (Karmarkar and Tormala 2009; Lee and Labroo 2004). More time attentionally engaging (eye movement data of greater fixations and longer durations) with the stimuli increases the subjects more favorable and effective communication and responses.

Hypotheses Development

The Effects of Advertising Personalization on Attentional Engagement

Attention is seen as a form of human perception and cognition in response to the immediate physical environment (Rahinel and Ahluwalia 2015). The personalization of advertising plays an important role in attracting the attentional engagement of consumers. For example, consumers' attention tends to be attracted by the sound and name of themselves. Tam and Ho (2005) found that website personalized information can increase users' attention and encourage more detailed processing of the content. Similarly, Malheriros (2012) also found that consumers pay more attention to a highly personalized advertisement on which their names and photos are displayed.

In this research, we also propose that location-based personalization can attract consumers' attention. The conceptual systems that govern human thought and behavior are fundamentally metaphorical in nature (Lakoff and Johnson 1980). One of the location-related metaphors is closeness-equals-strength-of-effect, under which people will rely on the default knowledge that a close location increases impact and relevance (Touré-Tillery and Fishbach 2017). Accordingly, a location-based advertisement can create a subjective experience of engagement that intensifies reactions to the object. When people experience strong engagement with something, they are involved, interested and attentive to it (Higgins and Kruglanski 2007). According to the marketing literature, the feeling of attentional engagement can be captured by the number of eye fixations and dwell time (the total time fixating on the target). More eye fixations and dwell duration mean that longer and more detailed information processing. According to the consistent finding that enhanced attentional engagement can favor ones' attitude to an advertisement, we hypothesize that:

H1: Compared with non-personalized advertising, location-based personalized advertising lead to greater attentional engagement: (a) number of fixations and (b) fixation duration.

The Effects of Advertising Personalization on Consumer Response

A great body of research has demonstrated that personalized product and service can lead to a more favorable response. Senecal and Nantel (2004) found that using a personalized recommendation system to push the same service can increase consumers' consumption possibility twice, compared to the ordinary marketing method. Pathak et al. (2010) also found that pushing products based on consumers' search history can enhance their purchase intention. In the context of personalized advertisement, previous studies also have suggested that consumers respond more favorably to an advertisement that is customized based on their interests. For example, personalized advertisement can lead to a higher click-through rate (Seckelmann et al. 2011).

We propose that location-based personalized advertisement can also positively influence consumers' response. As mentioned above, people will generate a feeling of engagement and relevance when they find the advertised merchant is close to them. This subjective experience creates a motivational force that absorbs and engrosses people (Higgins 2006). In the context of advertisement, the feeling of engagement intensifies their processing of the message advocacy (Lee et al. 2010). As people become attentive to and involved with the advertised information, they will feel right about it and thus

intensify their actions toward it, such as redeeming the advertising coupon and visiting the retailer. Thus, we propose the following hypotheses:

H2: Compared with non-personalized *advertising, location-based personalized advertising lead to a more favorable response.*

Hypotheses 1 and 2 also implicitly assume that:

H3: Attentional engagement will mediate the impact of location-based personalized advertising on consumer response.

Methodology

Stimuli

To test our predictions, one factor (personalized advertising vs. non-personalized advertising) between-subject experiment was designed and conducted by using eye-tracking technology. In order to make the experimental scenario close to life, we designed the experimental webpages based on the Baidu search result webpages. Specifically, we simulated the webpages of using Baidu to search for "restaurants". The left side of the page was the text section of the search results, which includes a list of 5 restaurants. To avoid the impact of restaurant names and prices on the choice of subjects, we randomly created the names of 5 restaurants covering many cuisines and did not show the prices. Besides the restaurant titles, we also included some basic descriptions. On the right side of the webpages, a rectangular banner advertisement of a restaurant named F Homemade Garden restaurant[1] was displayed, which was the focus of this experiment.

| Personalized version | Non-personalized version |

Figure 1. Experiment Stimuli

We manipulated the location-based personalization in two ways, as shown in Figure 1. On the webpages with the personalized advertisement, a location map of the advertised restaurant was added. On the map, participants would easily figure out that the restaurant was quite close to them. Second, a headline of "Welcome students from XXXX University" was added to guarantee that the participants would perceive that the advertisement was personalized for them. In contrast, the non-personalized version only had the picture of the dishes and the text description of the F Homemade Garden.

Measures

We have two mediating variables: number of fixations and fixation duration. These two variables are automatically recorded by the eye-tracking equipment. Our dependent variable is consumer response. We operationalize this variable by measuring participants' self-report perception of visiting intention toward the advertised restaurant. Based on existing valid and reliable instruments (Drossos et al.

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[1] On search engine, the advertisements displayed are usually the same to the content that users are searching. Therefore, we also choose the restaurants searching results as the advertisement context.

2013), we created three items (i.e., I will go to the advertised restaurant on the right side of the webpage; in the near future, it is highly possible for me to go to the advertised restaurant; I am planning to go the advertised restaurant). Last, we include two similar items to measure perceived personalization of the restaurant advertisement to check the success of manipulation (i.e., The restaurant advertisement on the right side of the webpage is personalized for me; The restaurant advertisement on the right side of the webpage is customized for me). All items were asked on a five-point Likert scale with a range from -2 ("fully disagree") to 2 ("fully agree"). The questionnaire was created in English and reviewed for content validity by a group of three academics. As our study was designed in the Chinese context, two graduate students independently translated the original items into Chinese, and then formed a consensus on the final version for the questionnaire. The Chinese items were translated back into English by another professional translator to confirm translation equivalence.

Participants and Procedure

We recruited students from a large university in China as participants in the main study. Students from design-related majors or with self-declared visual impairments (e.g., color blindness) were excluded from our experiment. All the participants have had at least 3-4 years of internet experience and online shopping experience of 3-5 times per month. 65 qualified participants who had attended our experiment were compensated with 15 Renminbi (Yuan) for their time and effort. The 65 participants were randomly divided into two groups: 33 of them browsed the webpage with personalized restaurant advertisement, and the rest browsed the webpage with the non-personalized advertisement. Among the 65 participants, 35 were female. The average age was 23.8.

Before participants entered the eye tracking laboratory, we explained to them the purpose of the study, the evaluation process and the eye tracking apparatus (i.e., EyeLink 1000 plus). After entering the laboratory, participants first learned how to operate the equipment and we adjusted the eye-tracker equipment in order to calibrate their eyes focus. The distance between the monitor and the participants' eyes was about 70 cm. To reduce the effect of head motion on the accuracy of eye tracking system, we asked participants to put their chins on the chin rest and we adjusted the height of chin rest for keeping their eyes as high as the central 2/3 position of the screen. We only started when the participants fully understood the procedure and their eyes focus were calibrated successfully. Before exposing the webpage stimulus, a guidance sentence was presented on the screen followed by a crosshair ("+") at the center of the screen to ensure that all the participants viewed the screen at the same starting point. Participants could browse the webpage as long as they want. After the eye movement experiment was completed, the subjects walked out of the laboratory and completed a questionnaire outside the laboratory. On the questionnaire, participants needed to indicate their visiting intention toward the advertised restaurant, perceived personalization of the advertisement as well as control variables including their taste preference, and demographic information.

Results

Reliability and Validity

We conducted a multilevel EFA using the principal component method with the default oblique Varimax rotation. According to the guideline set by Hair et al. (2010), loadings of 0.50 and above are considered significant, eigenvalues of factors should be greater than 1, and loadings should not be dispersed over factors. As shown in Table 1, all the items are loaded in the intended factors. The pattern of loadings and cross-loadings supports internal consistency and discriminant validity. Furthermore, According to Fornell and Larcker (1981), Cronbach's alpha values should be larger than 0.70 to establish reliability. Table 1 shows that all scores exceed the acceptable level, indicating significant convergent validity.

Table 1. Exploratory Factor Analysis and Cronbach Alpha

Items	Factor 1	Factor 2	Cronbach Alpha

Perceived Personalization 1	0.084	0.913	0.80
Perceived Personalization 2	0.193	0.878	
Visiting Intention 1	0.829	-0.024	0.84
Visiting Intention 2	0.893	0.205	
Visiting Intention 3	0.837	0.280	

Manipulation check

To check the success of advertisement personalization manipulation, we conduct an ANOVA test with perceived personalization as the dependent variable and advertising personalization manipulation as the independent variable. The results reveal a significant effect of advertising personalization manipulation such that participants perceive the personalized restaurant advertisement (M=-0.094) is more personalized than the one without personalization (M=-0.121, $F(1,63)=6.79$, $P<0.05$). Therefore, our manipulation of advertising personalization is successful.

Hypothesis Testing

The hypotheses H1a and H1b propose the effects of advertising personalization on the two dimensions of attentional engagement: number of fixation and fixation duration (the total dwell time on the advertisement). As these two constructs are highly correlated which is consistent with previous literature (Cian et al. 2014), we conduct a MANOVA test with both number of fixations and fixation duration as the dependent variables and advertising personalization as the independent variable. The results reveal that advertising personalization has significantly positive effects on number of fixations and fixation duration. Specifically, participants are more likely to re-fixate on the location-based personalized restaurant advertisement (M=82.18) than the one without personalization (M=34.81, $F(1,63)=30.10$, $P<0.001$). In terms of fixation duration, the results also suggest that participants have more dwell time on the personalized advertisement (M=21497 ms) than the one with no personalization (M=8713 ms, $F(1,63)=27.58$, $P<0.001$). Therefore, H1a and H1b are both supported. Compared to the non-personalized advertising, consumers put greater attentional engagement (greater fixation numbers and longer fixation durations) on the location-based personalized advertising.

In hypothesis 2, we propose that advertising personalization also has a positive effect on consumers' behavioral intention. An ANOVA test with visiting intention as the dependent variable and advertising personalization as independent variable reveal a significant effect of advertising personalization. Participants have higher visiting intention toward the restaurant with the personalized advertisement (M=1.12) than the one without personalization (M=0.60, $F(1,63)=11.73$. $P<0.001$). Thus, hypothesis 2 is supported. All the above results keep consistently if we include covariate variables such as age, gender, online shopping experience, taste preference.

Table 2. Indirect Effect Test

Mediator	Standardized Estimate	S.E.	95% Confidence Intervals	P Value
Number of Fixations	0.114	0.056	[0.005; 0.223]	0.04
Fixation Duration	0.200	0.070	[0.063;0.337]	0.004

To explicitly understand the mediation role of attentional engagement, we also examined the significance of indirect effects. We estimated two 1-1-1 indirect effect tests to examine the mediated effects of number of fixations and fixation duration respectively. Specifically, following Bauer et al.'s (2006) recommendation of estimating indirect effects, the indirect effects were computed as the product of the 'a' path (i.e., from independent variable to mediator) and the 'b' path (i.e., from mediator to dependent variable), plus the covariance between them (i.e., indirect effect = a×b+ cov(a,b)). The standardized coefficients of these indirect effects are presented in Table 2. Both number of fixations and fixation duration have significantly mediated effects on the impact of advertising personalization on visiting intention, supporting hypothesis 3. Compared to the advertising without location-based personalization, more time putting attentional engagement (greater fixation

numbers and longer fixation durations) induced by the location-based personalized advertising can foster consumers' more favorable behavioral responses.

Conclusion

This research-in-progress paper investigates the impacts of personalized online advertising on consumers' attentional engagement and response by using eye-tracking data. We validated that compared with non-personalized online advertising, personalized online advertising has a significantly positive impact on attention including number of fixations and fixation duration, and subsequently the enhanced attentional engagement can lead to higher visiting intention to the advertised merchant. These findings enhance the understanding of the effects of personalized online advertising and provide an insightful research perspective for studying online advertising. Our research can contribute to previous literature from two aspects. First, we contribute to previous literature on online advertising by examining the underlying cognitive process of the impact of advertising personalization. Specifically, we identify attentional engagement as an important mediator. Second, by using physiological measure – human eye movement, the current research also complements previous studies, in most of which only self-reported measures are used to understand the effects of advertising personalization. Furthermore, the findings of our research also have insightful applications for practitioners. We highlight the importance of advertising personalization which can attract online users' attention and responses. Therefore, advertisement designers should pay close attention to customize their advertisement content based on consumers' state and characters. In addition, our results suggest that location-based personalization can be a potential strategy for merchants to promote their products and services to attract more potential consumers.

As a research-in-progress paper, there are several limitations which can stimulate our future directions. First, we only focus on two types of eye movement data – fixation and duration to explore subjects' attention. However, there are other interesting data such as first fixation time, pupil size, and fixations on other webpage stimulus areas of interests (AOIs) such as headline and picture of dishes AOIs. In the future study, we will conduct a deeper exploration of eye movement data from different personalized adverting AOIs to have a better understanding of the effects of advertising personalization on consumers' attentional engagements and responses. Second, in the future study, we will examine the boundary conditions on the effect of advertising personalization.

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