http://dx.doi.org/10.15830/kmr.2018.33.1.65

The Effect of Repeated and Spaced Exposures of Internet Display Advertising

Janghyuk Lee, Donnel A. Briley, Jungsuk Oh, Se-Bum Park, and Sung Joo Bae

ABSTRACT

The present research examines the effects of repeat exposures and the amount of time elapsed between exposures to Internet banner ads on message recall based on the field data from seven actual Internet ad campaigns run in seven European countries. Our findings indicate that message recall rate to repeated and spaced banner ad exposures follows an inverted-U shape and increasing the time interval between exposures reduces the number of repetitions required to reach the maximum level of message recall.

Keywords: Banner Advertisement, Repeat Exposure, Message Recall, Spacing

The authors thank Nick Nyhan, the founder of DynamicLogic, for providing data. The first author thanks Amore Pacific for its research grant. This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2015S1A5B6036421).

Janghyuk Lee | Professor, Korea University, Business School(janglee@korea.ac.kr), Corresponding Author
Donnel A. Briley | Professor, The University of Sydney, School of Business
Jungsuk Oh | Professor, Seoul National University, College of Business Administration
Se-Bum Park | Associate Professor, Yonsei University, School of Business
Sung Joo Bae | Associate Professor, Yonsei University, School of Business

ISSN: 1229-456x (print)

Ⅰ. Introduction

Internet advertisement spending in U.S. has topped $30 billion for the first time to exceed that of cable television in 2011 and reached $59.6 billion in 2015 with a 21.7% annual growth rate since 2005 (Internet Advertising Bureau 2016). Despite this enormous increase in significance and popularity of Internet advertising as compared to the other advertising vehicles such as broadcast and cable television, recent investigations have raised doubts with regard to the effectiveness of Internet advertising, particularly that of Internet display or banner ads, because Internet users often avert looking at or paying attention to Internet banner ads to which they are repeatedly exposed (Benway 1998; Burke et al. 2005; Chatterjee 2008; Drèze and Hussherr 2003; Hervet et al. 2011). This phenomenon referred to as banner blindness (Benway 1998) can decrease the return on Internet advertising spending and, as a result, make Internet advertising campaign more costly than other types of advertising campaigns as the costs of delivering Internet banner ads are usually determined by exposure-based models. Indeed, GM has pulled its $10 million Internet display ads budget from Facebook, acknowledging that its Facebook ads had little impacts on consumers' car purchases (Terlep, Vranica, and Raice 2012). In fact, spending on banner advertisement decreased from 48% of total Internet ad spending in 2001 to 31.3% in 2016 while search ad increased from 4% in 2001 to 48.0% in 2016. (Internet Advertising Bureau 2002, 2017)

While marketers start to cast doubts on the effectiveness of Internet banner ads, recent investigations have shown that Internet banner ads exert significant impacts on traditional memory-based measures such as brand awareness, brand recognition, and message recall (Burke et al., 2005; Drèze and Hussherr 2003), click-through rates (Cho, 2003; Chatterjee 2008; Chatterjee, Hoffman, and Novak 2003; Dahlén 2001; Drèze and Hussherr 2003; Sherman and Deighton 2001), eye fixation (Drèze and Hussherr 2003; Hervet et al. 2011), and product purchase (Manchanda et al. 2006). Relatively little effort, however, has been directed toward investigating how the effects of repeat exposures and of the time elapsed between exposures can vary over a multiple period of times in the real-life Internet setting where Internet users have substantial control to manage what content of Internet banner ads they view versus avoid and the extent to which they process the content of Internet banner ads (repeatedly) exposed to (Ariely 2000; Hoffman and Novak 1996, 2000; Leong, Huang, and Stanners 1998). Together with Internet user's navigational goal (Novak, Hoffman, and Yung, 2000; Pagendarm and Schaumburg 2001), the greater control of information flow in Internet media allows Internet users to determine the actual number of exposures and the amount of time elapsed between exposures to varying degrees, which in turn significantly affect the pattern of repeat exposures to Internet banner ads and thus determine the effectiveness of Internet banner ads in the real-life Internet setting.

The primary aim of this research is thus to investigate how Internet users' message recall changes as a function of the number of repeat exposures and the amount of time elapsed between exposures over time based on the analysis of the field data showing users' responses to actual Internet banner advertising campaigns run by seven different consumer electronics brands. Our findings provide the different shapes of response function for message recall that shed important insights regarding the optimal number of message exposures, the effect of message spacing, and the pricing of Internet banner advertising campaign.

II. Theoretical Background

1. The Effect of Repeat Exposures

Since the first simple static Internet banner ad appeared on HotWired in 1994, Internet display ads (e.g., static or floating banner ads, pop-up ads, rich media, or digital video) have been considered one of major advertising vehicles for building brands through better brand recognition and attitudes and obtaining measurable direct consumer responses to advertised brands Internet through greater click-through rates (Hollis 2005). To date multiple number of studies have reported that Internet display ads are more likely than traditional print advertisements to facilitate consumer learning and recall of low involvement products (Dahlén, Murray, and Nordenstam 2004), to enhance consumer attitudes toward brands (Burns and Lutz 2006; Gallagher, Foster, and Parsons 2001), and to solicit higher click-through rates (Cho, Lee, and Tharp 2001) and more favorable responses to promotional offers (Kimefeld and Watt 2001) (see Ha 2008 for a review).

According to an eye-tracking study by Drèze and Hussherr (2003), however, repeat exposures to Internet banner ads led to very low click-through rates due to the lack of consumer attention although brand awareness, unaided message recall, and aided brand recognition were significantly improved. Burke et al. (2005) and Zhang (2000) showed that the recall of Internet banner ad messages was very low because consumers avoided looking directly at Internet banner ads that interfered with their primary tasks. In addition, pop-up display ads often invoked negative consumer attitudes and reactance due to irritation and ad avoidance (Cho and Cheon 2004; Edwards, Li, and Lee 2002). Relatedly, Pieters, Rosbergen, and Wedel (1999) indicated that repeat exposures to a print advertisement reduced the amount of attention paid to its messages by nearly 50% over three repeated exposures while the sequences of eye-fixation, called scanpaths, remained stable from the first to the third exposure. Similar findings were also found in other studies (Dahlén 2001; Sherman and Deighton 2001) where repeat exposures to Internet banner ads generated click-through rates as low as 1% on average. Craig, Sternthal, and Leavitt (1976) demonstrated that a greater number of ad repetitions led to poorer message recall rates unless consumer inattention and reactance were experimentally controlled. In sum, all the findings above generally suggest that the lack of attention to or consumer ignorance of Internet banner ads may account for lower message recall and click-through rates in most of Internet repeat ad exposures contexts in which consumer themselves have greater control over exposure duration, the number of exposures, and the time elapsed between banner exposures.

What further exacerbates this consumer-controlled repeated exposure situation is that clicking Internet banner ads is considered a voluntary and deliberate action with the objective of viewing more precise messages in ads (Raman and Leckenby 1998). An Internet banner ad typically employs less than 10% area of a standard computer screen and has to compete for consumer attention with other focal elements of a webpage (Drèze and Hussherr 2003). As the Gestalt principle of figure and ground posits, prominent and well-defined focal information related to primary tasks (the figure) becomes the focal point of attention whereas less prominent, indefinite information (the background) such as (repeated) Internet banner ad messages fades away. As such, voluntary exposures to repeated Internet banner ads are highly likely to be affected by Internet users' navigational goal that can direct available attentional resources away from non-central stimuli such as Internet banner ads to their primary tasks (Novak et al. 2000; Schroeder 1998). Pagendarm

and Schaumburg (2001), for example, demonstrated that casual, aimless browsers were more likely than goal-driven searchers to exhibit greater message recall of Internet banner ads. Pieters and Warlop (1999) found that consumers under greater motivation to evaluate brands exhibited longer eye-fixation duration than those under lower motivation. Similarly, Dahlén (2001) indicated that the effects of repeat exposures to Internet banner advertisements on the awareness and attitude of brand were different depending on brand familiarity, indicating that repeat exposures improved brand awareness and brand attitude only when Internet users had less than 6 months of experience with a target brand. Cho (2003) also found that Internet users who were more involved with target products in Internet banner ads were more likely than those who were less involved to seek additional information by clicking the Internet banners.

Based on our review of existing literature on the effects of repeat exposures to Internet banner ads, we assume that there are two different patterns of consumer responses to repeated exposures of Internet banner ads. One possibility is that the probability of consumers attending banner ad message drops off as the number of exposures increases. As with print advertising, the first exposure to Internet banner ad message may offer sufficient opportunity to elicit consumer responses (Calder and Sternthal 1980). Reinforcing this pattern would be the fact that consumers' full attention is most likely when Internet banner ad message is first encountered and therefore the most novel (Johnston et al. 1990). DoubleClick's study (1996), for example, indicated that click-through rates were highest on the first banner exposure (2.7%) and started to decline with each additional exposure, dropping to less than 1% after only four exposures of banner ads. Consistent with this line of reasoning, Benway (1998) and Schroeder (1998) maintained that consumers ignored Internet banner ads right after they attended them, and became increasingly insensitive. Likewise, Chatterjee et al. (2003) concluded that the effects of repeated display ad exposures on click-through rates followed a non-linear trajectory, demonstrating that click-through rates were highest at the first exposure and then started to decrease until the 11^{th} exposure of banner ads.

The other possibility is the inverted-U pattern of consumer responses to repeated Internet banner ads. First, message recall increases as consumers become more attentive to banner ad message with more exposures during the phase of wear-in. Second, during the phase of wear-out consumers experience tedium from additional exposures (Schumann, Petty, and Clemons, 1990) because they are satiated with banner ad message (Cacioppo and Petty 1979). As a result, consumers increasingly ignore banner ad message (Calder and Sternthal 1980) as shown in Drèze and Hussherr (2003). Manchanda et al. (2006), for example, indicated that the shape of the curve displaying the effect of ad exposure frequency on purchase probability was concave although Internet shoppers were exposed .32 times on average and no more than eight exposures in their study. More importantly, recent investigations on short-term memory decay revealed that both the passage of time and interference from other task materials accounted for forgetting in the short-term (Berman, Jonides, and Lewis 2009; Oberauer and Lewandowsky 2008). Given that many other pieces of information and materials of interests on websites are interfering with Internet banner ads in order to gain Internet users' attention, we expect that message recall will decrease over time after message recall has reached its peak level.

Taken together, we hypothesize that Internet users will be getting more attentive to Internet banner ads during the wear-in phase whereas they will become less attentive during the wear-out phase. Even though Internet users may not fully attend to Internet banner ads in the real-life Internet

setting, each additional banner exposure during the wear-in phase will generate feeling of familiarity and curiosity due to pre-attentive message processing (Janiszewski 1993). Beyond a certain level of repeat exposures at which satiation kicks in, however, the passage of time and interference from other task materials of focal interests will contribute to the decrease in message recall rates in the wear-out phase during which fewer attentional resources are allocated to processing banner ads.

2. The Effects of Message Spacing

The number of exposures to Internet banner ads alone may not provide a sufficient account for the effects of repeated banner exposures on message recall. In developing a media schedule, marketers also need to make a decision about the timing of repeat exposures, which is a decision as to whether repeat exposures of Internet banner ads should be spaced or massed over time. Marketers, for example, may want to either increase (i.e., spaced or distributed repetitions) or decrease the time interval (i.e., massed repetitions) between exposures to facilitate message recall. Malaviya and Sternthal (1997), for example, indicated that spaced ad repetitions were more likely than massed ad repetitions to prompt the allocation of more cognitive resources to ad stimulus because spaced exposures were perceived as less familiar. Recently, Appleton-Knapp, Bjork, and Wickens (2005) also found that spaced ad repetitions led to greater message recall when the time interval was short rather than long, demonstrating that the persuasive benefits of spaced ad repetitions were derived primarily from the study-phase retrieval process.

To date a substantial amount of research on the message spacing effect, referred to as the advantage in memory for spaced over massed ad repetitions, has demonstrated that spaced repetitions are more likely than massed repetitions to improve message recall and advertising effectiveness whereas this persuasive advantage of spaced repetitions is highly dependent upon the characteristics of advertising stimulus and contextual cues (see Goodrich 2011; Janiszewski, Noel, and Sawyer 2003; Noel and Vallen 2009 for a review). While there is no single dominant theoretical account for the processes that underlie a variety of message spacing effects (Toppino and Schneider 1999), theoretical consensus on the advantage of spaced ad repetitions over massed ad repetitions appears to exist. The attention hypothesis (Hintzman 1974), for example, states that massed repetitions lead to lower message recall because people voluntarily pay less attention to repeated exposures that occur shortly after the first exposure. Similarly, the rehearsal hypothesis (Rundus 1971) assumes that massed ad repetitions reduce the time for people to rehearse information provided at the first exposure when repeated exposures quickly follows. The encoding variability (Glenberg 1979; Melton 1970; Unnava and Burnkrant 1991) predicts that spaced repetitions of ads with varied formats and contents for the identical brands improve message recall because increasing the amount of time elapsed between exposures under this circumstance allows the formation of more cue-target associations. The retrieval or the study-phase retrieval hypothesis (Appleton-Knapp et al. 2005; Braun and Rubin 1998; Greene 1989) indicates that spaced repetitions result in better message recall because repeated exposures to ad message can serve as a clue for the involuntary retrieval of ad message encoded at the first exposure particularly when the first encounter is restored from long-term rather than short-term or working memory. Similar to the study-phase retrieval hypothesis, the reconstruction or the accessibility hypothesis (Jacoby 1978; Noel 2006) posits that spaced repetitions are more likely than massed repetitions to prompt the allocation of greater

resources to reconstructing ad message encoded at the first exposure, thereby resulting in better message recall. To summarize, most theoretical accounts favors the persuasive advantage of spaced repetitions over massed repetitions, meaning decreasing the time interval between exposures is likely to reduce the rate of correct message recall, although the message spacing effects vary as a function of stimulus, media, contextual, and audience characteristics (Janiszewski et al. 2003).

Consistent with previous literature on the message spacing, we hypothesize that a fewer number of repeat exposures will be required to reach the peak level of message recall when the time interval between exposures is long rather than short because the longer time interval between exposures prompts the allocation of greater resources than needed to process ad message due to the lack of familiarity. It is, however, hypothesized that message recall will decrease more quickly under the longer time interval than the shorter time interval between exposures because the likelihood that both the passage of time and interference from other primary information of interests facilitate the process of short-term memory decay is greater under the longer time interval condition.

III. Data

Data collection involved two steps. First, Internet users who had been exposed one or more times to one of seven target Internet banner ad campaigns run in European countries including Spain, The Netherlands, Sweden, Hungary, Poland, The United Kingdom, and Germany were identified and tracked to determine the exposure number to a target ad. Each time a new Internet user loaded a web page on which a target ad was posted, his or her computer was tagged by downloading a cookie, which then kept a count of the number of downloads of these target pages.

Second, Internet users who were exposed to one of the seven target Internet banner ad campaigns saw a pop-up window that asked them to take a brief Internet survey in return for a chance to win $150. After clicking a link in the pop-up window, they were routed to a separate website where questions about their memory of and reactions to a target banner ad and its brand were posed. Internet users pursued their own genuine web-surfing goals, unaware of their participation in the study while they were left to the exposition of the target ad during this natural process. The exposure number and the time elapsed between banner exposures were determined by each Internet user's navigation pattern so as to reflect more natural repeat exposure contexts.

Third, the current research employed a control group that included Internet users who had visited the website on which target Internet banner ads were posted, but who had not downloaded any of the specific pages that held these target ads. Internet users who met these criteria were randomly selected to form control group participants. The control group participants were intercepted and asked to complete the same Internet survey to win $150 as participants in the repeat exposure group. The control group allowed us to make comparisons between repeat exposures and baseline condition, and to avoid demand characteristics that might have occurred when evaluations were solicited from a single group both before and after banner exposure (e.g., Drèze and Hussherr 2003).

1. Respondents and Advertising Campaigns

Of the seven Internet banner ad campaigns, the campaigns 1 to 5 were run in December 2001 and the campaigns 6 and 7

in May and June 2002. These Internet banner ad campaigns were run by consumer electronics brands, and were posted on popular websites that potential buyers might frequent, such as websites for consumer electronics magazines or Internet retailers. These Internet banner ad campaigns were run over a 7-month period, and reflected advertising themes that were communicated through the other offline media. Accordingly, our data allowed us to estimate the marginal benefit of using an Internet banner ad campaign because research participants were also exposed to the same advertising message through the other offline media. Out of 5,063 Internet users who visited the target websites, a total of 2,500 Internet users (M_{age} = 30.8 years, 37% females) responded to our Internet questionnaire. As summarized in Table 1, the duration of the 7 Internet banner ad campaigns varied from 11 to 20 days. The average number of times our survey respondents were exposed to each Internet banner ad ranged from 2.32 to 4.56, with the average across campaigns being 3.36 banner exposures. Ninety percent of respondents completed the survey within 19 minutes of their last message exposure.

2. Measures

All measures were collected via the Internet questionnaire. First, an (aided) message recall was measured by asking participants to correctly associate a target brand and its advertising tagline (1 = correct recall, 0 = incorrect recall). We chose the message recall measure instead of a click-through rate because prior research indicated that Internet users attended to and were influenced by banner ads even when they did not click on banners (Briggs and Hollis 1997; Drèze and Hussherr 2003; Manchanda et al. 2006). These Internet users in the real-life setting were not forced to view banner ads, to watch repeated banner exposures over the course of minutes or hours, and respond to banner ads within several minutes of exposure unlike those in the controlled laboratory experiments (Pechmann and Stewart 1988). Second, brand awareness was measured by displaying participants a list of five consumer electronics brands, one of which was the target brand, and asking them to indicate whether they were aware of the target brand (1 = not aware of, 2 = not sure, 3 = aware of). Third, participants were requested to evaluate the five target brands on a five-point scale in terms of their overall brand attitude (1 = very unfavorable, 5 = very favorable) and likelihood of purchase (1 = very unlikely, 5 = very likely). Last, participants completed their demographics items and indicated whether or not they used a shared public computer or their own. Participants who used a shared public computer were removed

〈Table 1〉 Campaign Descriptive Statistics

Campaign	Country	Observations			Duration (days)	Exposure		
		Total	Exposure	Control		Mean	Max	S.D.
1	Spain	733	375	358	15	4.14	147	11.12
2	Netherlands	751	376	375	13	2.51	82	5.46
3	Sweden	722	347	375	19	3.83	91	7.20
4	Hungary	751	373	378	11	2.43	28	3.12
5	Poland	703	328	375	12	2.32	74	4.66
6	UK	604	301	303	20	3.61	75	7.32
7	Denmark	799	400	399	15	4.56	452	23.24

Note. DE: Germany, ES: Spain, H: Hungary, NL: The Netherlands, PL: Poland, SE: Sweden, UK: The United Kingdom.

from our analysis to avoid identification errors.

Ⅳ. Results

1. The Effect of Repeat Exposure on Message Recall

A simple logistic regression was employed to estimate the effect of repeat exposure on message recall. To test our prediction, we first made a comparison between subjects in the control group and those in the repeat exposure group. The control group participants were considered establishing a baseline for non-Internet media influence although they could have been exposed to the same message through the other offline media channels. Given that the both groups potentially had been exposed to the other media channels that communicated the identical messages, this comparison was considered providing additional insights as to whether the Internet banner advertising campaigns were attended and could offer a contribution over and above the other media channels in the communication mix. As shown in Table 2, our analysis indicated that Internet banner ads improved message recall rate significantly compared to the control group whereas almost no significant differences were found for brand awareness (except for the campaign 6), brand favorability (except for the campaign 2), and purchase intention. These findings were consistent with Briggs and Hollis (1997) and Dahlén (2001) in which Internet banner ads had no significant impacts on consumer loyalty and brand attitude toward familiar brands as in the current research.

Included in our models were message recall, profile variables such as gender, age, brand awareness, and dummy variables for each campaign to capture campaign-specific effects. Different transformations of exposure frequency were tested in our models in order to determine which model would offer the best model fit. For the model fit measures, the log-likelihood, Cox-Snell's R^2, and Nagelkerke's R^2 of each model (Nagelkerke 1991) were reported. As shown in Table 3, we first ran a baseline model (M_0) that contained only the profile variables mentioned above prior to testing the effects of repeat exposure on message recall. The analysis indicated that message recall was better for respondents who were young rather than old (β = -.027, SD = .003, p < .01) and females rather than males (β = -.302, SD = .059, p < .01). The analysis also showed that respondents who were familiar were more likely than those who were unfamiliar with the target brands to exhibit greater recall of the Internet banner advertising messages (β = 1.081, SD =

〈Table 2〉 Campaign Performance

Campaign	Message recall		Brand awareness		Brand favorability		Purchase intention	
	Control	Exposed	Control	Exposed	Control	Exposed	Control	Exposed
1	24.3%	34.4% **	95.8%	94.4%	3.76	3.73	3.16	3.27
2	22.1%	31.4% **	99.2%	98.9%	3.58	3.45 **	3.19	3.15
3	18.9%	26.5% *	98.4%	96.5%	3.34	3.35	3.11	3.07
4	21.2%	33.2% **	99.2%	99.7%	3.65	3.61	3.40	3.46
5	37.9%	49.1% **	97.1%	97.9%	3.29	3.35	2.86	2.96
6	12.9%	20.9% **	96.7%	99.7% **	3.68	3.66	3.37	3.44
7	9.0%	15.3% **	93.7%	96.3%	3.37	3.41	2.70	2.74

* p 〈 .05. ** p 〈 .01

.179, $p < .01$). The analysis of baseline message recall rates for each campaign represented by the campaign dummy variables indicated that the target campaigns differed widely in their effectiveness while some campaigns had significant negative and the others showed significant positive coefficients.

To find the best model that could account for the effect of repeat exposure on message recall, we tested two different types of approach: wear-in effect only (M_1 and M_2) and both wear-in & wear-out effects (M_3). In the first model (M_1) we added the number of times our respondents were exposed to the target Internet banner ads as a predictor in addition to the profile variables. As compared to our baseline model (M_0), M_1 model with wear-in effect only improved the overall model fit very little and the repeat exposure effect was not significant enough in the real scale. To improve the model fit and to find significant repeat exposure effects, we changed the scale of exposure frequency by taking its natural log in M_2 in a manner to attenuate the magnitude of repeat exposure effect. As respondents in the control group were not exposed to the ads at all, we added one to this scale transformation, ln(Exposure#+1). The results of M_2 showed the significan repeat exposure effect in the wear-in phase with subtantial improvement of the model fit compared to M_1.

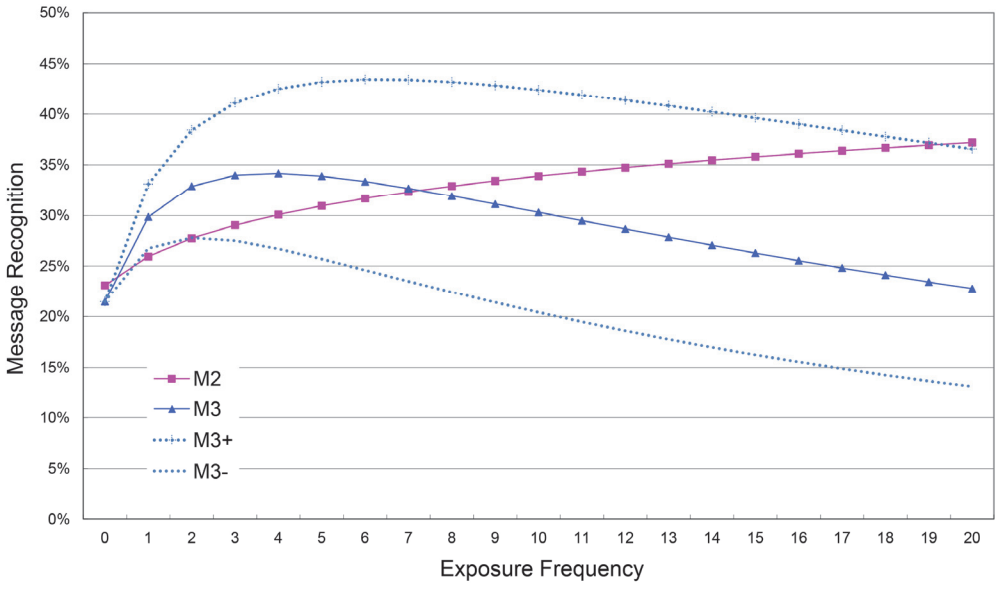
In M_3, we included the square of this term, $[\ln(\text{Exposure\#}+1)]^2$ in order to capture the wear-out effect as well. Further improvement in terms of model fit was achieved by the introduction of the squared term compared to M_2. Therefore, we consider M_3 with both wear-in and wear-out phases is the best model that captures the repeat exposure effect on message recognition rate. Figure 1 shows the pattern of

〈Table 3〉 Repeat Exposure Effect on Message Recall

	Models							
	M_0		M_1		M_2		M_3	
Variables	Beta	S.E.	Beta	S.E.	Beta	S.E.	Beta	S.E.
Age	-0.021	0.003***	-0.021	0.003***	-0.022	0.003***	-0.024	0.004***
Gender (male=1)	0.211	0.070***	0.211	0.070***	0.179	0.070***	0.197	0.070***
Aided awareness	0.576	0.248**	0.576	0.248**	0.564	0.249***	0.564	0.249***
Exposure #			0.001	0.004				
ln (Exposure #+1)					0.223	0.045***	0.817	0.110***
{ln (Exposure #+1)}^2							-0.260	0.046***
Constant	-2.003	0.282***	-2.004	0.282***	-2.081	0.284***	-2.179	0.285***
Survey dummy		***		***		***		***
Campaign 1	1.064	0.136***	1.064	0.136***	1.069	0.136***	1.086	0.137***
Campaign 2	0.915	0.137***	0.916	0.137***	0.944	0.137***	0.936	0.138***
Campaign 3	0.796	0.141***	0.797	0.141***	0.809	0.142***	0.838	0.142***
Campaign 4	0.896	0.137***	0.897	0.137***	0.923	0.138***	0.909	0.138***
Campaign 5	1.543	0.134***	1.545	0.135***	1.581	0.135***	1.574	0.135***
Campaign 6	0.403	0.154***	0.403	0.154***	0.405	0.155***	0.411	0.155***
(Baseline) Campaign 7								
LL	-2730.568		-2730.550		-2718.797		-2699.342	
Cox-Snell's R^2	0.053		0.053		0.058		0.065	
Nagelkerke's R^2	0.079		0.079		0.085		0.096	

N=5,063

〈Figure 1〉 The Effect of Repeat Exposures on Message Recall



message recall by the number of exposures for the models M_2 and M_3. In addition to M_3, its bounds of 95% confidence interval are depicted in dashed lines (M_3- and M_3+). According to M_3, additional exposures to the Internet banner advertising were beneficial up to the fourth time (peak at 3.8 exposures) it was shown where 34.17% of respondents had accurate message recall. In the control group, 21.47% of respondents had accurate recall, indicating that Internet banner advertising increased by 59% the number of people who processed the message.

2. The Effect of Message Spacing on Message Recall

Next, we examined how message recall was affected by the time amount that elapsed between the first and the last exposure, or the average time interval between exposures. To determine whether longer versus shorter interval between exposures were differentially effective for the target Internet banner advertising campaigns, we compared the pattern of effects of repeat exposures on message recall when the average exposure time interval was short and long. We split the exposed group participants having multiple exposures into a short- and a long-interval group on a median of the time elapsed between exposures (11.19 hours). The control group and one exposure respondents were included in both groups. The average exposure interval was 2.94 hours for the short-interval group and 36.15 hours for the long-interval group. We then ran separate logistic regressions for each of these two groups using the quadratic form from M_3.

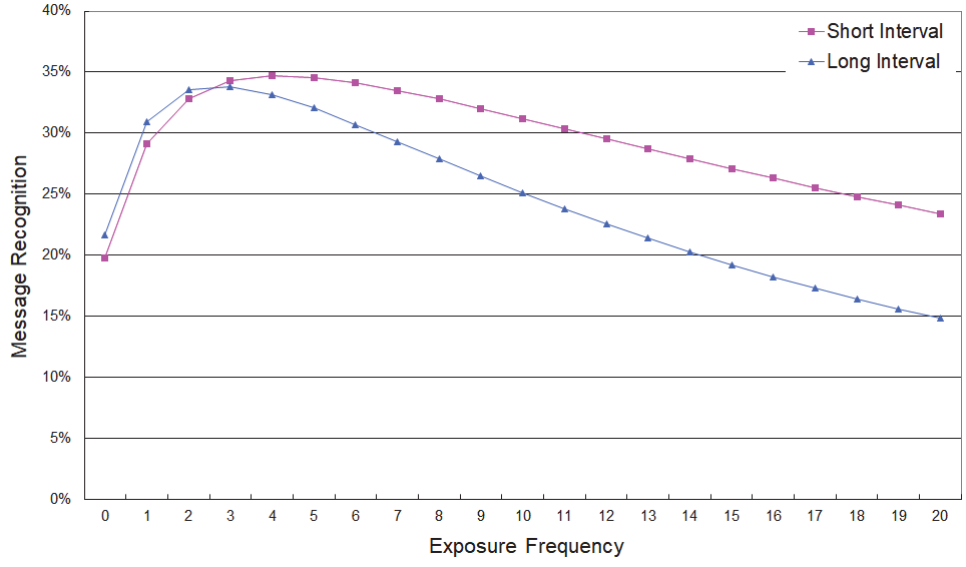
According to M_3 response functions for both groups shown in Table 4 and Figure 2, the model fit was similar for the two groups. Our analysis, however, revealed important differences between the two groups. That is, participants needed more exposures to reach their peak level of message recall when the exposure interval was short (4.2 exposures) rather than long (2.7 exposures), indicating that longer time interval might have prompted greater resource allocation due to the lack of familiarity. As Figure 2 indicates, however, the marginal benefit of additional exposures decreased more

〈Table 4〉 Message Spacing Effects on Message Recall

Variables	Models			
	M_4 Short Interval		M_4 Long Interval	
	Beta	S.E.	Beta	S.E.
Age	-0.022	0.004***	-0.025	0.004***
Gender (male=1)	0.197	0.075***	0.215	0.075***
Aided awareness	0.598	0.263**	0.637	0.267**
ln (Exposure #+1)	0.933	0.119***	0.940	0.143***
(ln (Exposure #+1))^2	-0.283	0.049***	-0.359	0.077***
Constant	-2.267	0.301***	-2.244	0.305***
Survey dummy		***		***
Campaign 1	1.102	0.146***	1.077	0.149***
Campaign 2	0.899	0.147***	0.899	0.149***
Campaign 3	0.821	0.153***	0.850	0.155***
Campaign 4	0.910	0.149***	0.915	0.148***
Campaign 5	1.598	0.146***	1.529	0.145***
Campaign 6	0.407	0.171***	0.466	0.164***
(Baseline) Campaign 7				
LL		-2410.571		-2390.276
Cox-Snell's R^2		0.067		0.062
Nagelkerke's R^2		0.098		0.093

N=4,532

〈Figure 2〉 The Effect of Short vs. Long Interval between Exposures on Message Recall



quickly after the peak under the long-interval than under the short-interval. Interestingly, the peak levels of message recall were similar for the short-interval (34.69%) and the long-interval (33.84%) groups despite the fact that the exact shape of the response curve differed depending on whether the interval between exposures was long or short. As hypothesized, the acceleration of short-term memory decay in the longer time interval condition would be attributed to the passage of time and the interference from other primary information of interests that drew greater attention from our research participants than did the Internet banner ad message.

Ⅴ. Summary and Discussion

Despite the ongoing skepticism about the effectiveness of Internet banner ads, marketers have been considering Internet banner ads the second most popular advertising format for building brands and obtaining direct consumer responses. According to IAB report, 31.3% of Internet advertising budget in the U.S. was spent on display/banner ad format in 2016 following search ad format of 48.0%. As a growing number of Internet users avoid or ignore exposures to banner ads, repeated and spaced repetitions of banner ads hardly pay off due to difficulty in drawing necessary attention from Internet users who are rather focused on their primary tasks. Based on the field data showing consumer responses to seven actual Internet banner ad campaigns run in seven European countries, we examined the effects of repeat exposures and the time interval between exposures on message recall. Our findings indicated that Internet users' responses to repeated and spaced banner ad exposures followed an inverted-U shape function, demonstrating that the rate of correct message recall increased and dropped off after the fourth exposure as the number of repeat exposures increased. Our findings also revealed that increasing the time interval between exposures reduced the number of repetitions required to reach the maximum level of message recall whereas decreasing the time interval between exposures after the peak decelerated the process of short-term memory decay. The current research departed from much of past research in this area by examining consumer responses to actual Internet banner ads in the real-life environment. Additionally, the current research made comparisons between the control and the exposure groups so that more meaningful assessments of the advantages of repeat exposures and the length of time interval between exposures could be made.

The current research makes three important contributions in the discussion of the effects of repeat exposures and message spacing on consumer responses to Internet banner ads. First, the findings suggest that the probability of gaining consumer attention does not decline right after the first exposure, as indicated by the previous findings on click-through rates (Chatterjee et al. 2003; DoubleClick 1996). Instead, the current research shows that consumer response patterns generally follow an inverted-U shape such that message recall increases initially, and then drops off after the peak. The inverted-U shaped response to the repeated exposures of Internet banner ads also provides the following important managerial implications. Regarding the optimal number of exposures, the peak message recall rate can be reached at the fourth exposure in our generalized response function.

Despite all the merits, however, the current research also has certain limitations that offer avenues for further research. First, our data focus only on the Internet banner advertising campaigns executed in 7 European countries. While the same methodology used in this research—Internet surveys and exposure counting using electronic cookies—can be applied in future investigations across different countries,

possible moderators such as the type of Internet advertising campaigns (e.g., rich media ad, floating banner ads) should also be taken into account to enhance the generalizability of the findings. Second, our data are not rich enough to thoroughly explore the effects of exposure interval length. In our analysis, we were not able to test directly the effects of message spacing (Janiszewski et al. 2003). Further effort should be directed toward investigating the effectiveness and efficiency of Internet banner ads on each website because websites have different intervals between exposures. Last, our data do not capture possible interactive effects between Internet banner ads and other media ads to which surveyed individuals might have been exposed. Though our control group is able to establish a baseline that reflects the influence of other media, it is possible that responses to our target ads are not independent of their exposures to these other media.

〈Received January 8. 2018〉
〈1st Revised January 30. 2018〉
〈2nd Revised February 18. 2018〉
〈Accepted February 20. 2018〉

References

Appleton-Knapp, Sara L., Robert A. Bjork, and Thomas D. Wickens (2005), "Examining the Spacing Effect in Advertising: Encoding Variability, Retrieval Processes, and Their Interaction," *Journal of Consumer Research* 32(2), 266-276.

Ariely, Dan (2000), "Controlling the Information Flow: Effects on Consumers' Decision Making and Preferences," *Journal of Consumer Research* 27(2), 233-248.

Benway, Panero J. C. (1998), "Banner Blindness: The Irony of Attention Grabbing on the World Wide Web," *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 42(5), 463-467.

Berman, Marc G., John Jonides, and Richard L. Lewis (2009), "In Search of Decay in Verbal Short-Term Memory," *Journal of Experimental Psychology: Learning, Memory, and Cognition* 35(2), 317-333.

Briggs, Rex and Nigel Hollis (1997), "Advertising on the Web: Is there Response before click-through?" *Journal of Advertising Research*, 37(2), 33-45.

Braun, Kelly Ann and David C. Rubin (1998), "The Spacing Effect Depends on an Encoding Deficit, Retrieval, and Time in Working Memory: Evidence," *Memory* 6(1), 37-65.

Burke, Moira, Anthony Hornof, Erik Nilsen, and Nicolas Gorman (2005), "High-Cost Banner Blindness: Ads Increase Perceived Workload, Hinder Visual Search, and Are Forgotten," *ACM Transactions on Computer-Human Interaction* 12(4), 423-445.

Burns, Kelli S. and Richard J. Luts (2006), "The Function of Format: Consumer Responses to Six Online Advertising Formats," *Journal of Advertising* 35(1), 53-64.

Cacioppo, James T. and Richard E. Petty (1979), "Effects of Message Repetition and Position on Cognitive Response, Recall and Persuasion," *Journal of Personality and Social Psychology*, 37(1), 97-109.

Calder Bobby J. and Brian Sternthal (1980), "Television Commercial Wearout: An Information Processing View," *Journal of Marketing Research*, 17(2), 173-86.

Chatterjee, Patrali (2008), "Are Unclicked Ads Wasted? Enduring Effects of Banner and Pop-Up Ad Exposures on Brand Memory and Attitudes," *Journal of Electronic Commerce Research*, 9(1), 51-61.

Chatterjee, Patrali, Donna L. Hoffman, and Thomas P. Novak (2003), "Modeling the Clickstream: Implications for Web-Based Advertising Efforts," *Marketing Science*, 22(4), 520-541.

Cho, Chang-Hoan (2003), "Factors Influencing Clicking of

Banner Ads on the WWW," *Cyber Psychology and Behavior*, 6(2), 201-215.

Cho, Chang-Hoan and Hongsik J. Cheon (2004), "Why Do People Avoid Advertising on the Internet?" *Journal of Advertising*, 33(4), 89-99.

Craig, C. Samuel, Brian Sternthal, and Clark Leavitt (1976), "Advertising Wearout: An Experimental Analysis," *Journal of Marketing Research*, 13(4), 365-372.

Dahlén, Micael (2001), "Banner Advertisements through a New Lens," *Journal of Advertising Research*, 41(4), 23-30.

Dahlén, Micael, Malcom Murray, and Sven Nordenstam (2004), "An Empirical Study of Perceptions of Implicit Meanings in World Wide Web Advertisements versus Print Advertisements," *Journal of Marketing Communications*, 10(1), 35-47.

DoubleClick (1996), Research Findings: Banner Burnout. [URL no longer available]

Drèze, Xavier, and François X. Hussherr (2003), "Internet Advertising: Is Anybody Watching?" *Journal of Interactive Marketing*, 17(4), 8-23.

Edwards, Steven M., Hairong Li, and Joo-Hyun Lee (2002), "Forced Exposure and Psychological Reactance: Antecedents and Consequences of the Perceived Intrusiveness of Pop-Up Ads," *Journal of Advertising*, 31(3), 83-95.

Gallagher, Katherine, K. Dale Foster, and Jeffrey Parsons (2001), "The Medium is not the Message: Advertising Effectiveness and Content Evaluation in Print and on the Web," *Journal of Advertising Research*, 41(4), 57-70.

Glenberg, Arthur M. (1979), "Component-Levels Theory of the Effects of Spacing of Repetition on Recall and Recognition," *Memory and Cognition*, 7(2), 95-112.

Goodrich, Kendall (2011), "Anarchy of Effects? Exploring Attention to Online Advertising and Multiple Outcomes," *Psychology and Marketing,* 28(4), 417-440.

Greene, Robert L. (1989), "Spacing Effects in Memory: Evidence for a Two Process Account," *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15(3), 371-377.

Ha, Louisa (2008), "Online Advertising Research in Advertising Journals: A Review," *Journal of Current Issues and Research in Advertising*, 30(1), 31-48.

Hervet, Guillaume, Katherine Guérard, Sébastien Tremblay, and Mohamed S. Chtourou (2011), "Is Banner Blindness Genuine? Eye Tracking Internet Text Advertising," *Applied Cognitive Psychology,* 25(5), 708-716.

Hintzman, Douglas L. (1974), "Theoretical Implications of the Spacing Effect," in *Theories in Cognitive Psychology: The Loyola Symposium*, ed. Robert L. Solso, Hillsdale, NJ: Erlbaum, 77-99.

Hoffman, Donna. L., and Thomas P. Novak (1996), "Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations," *Journal of Marketing,* 60(3), 50-68.

Hoffman, Donna L. and Thomas P. Novak (2000), "Acquiring Customers on the Web," *Harvard Business Review*, (May-June), 179-188.

Hollis, Nigel (2005), "Ten Years of Learning on How Online Advertising Builds Brands," *Journal of Advertising Research*, 45(2), 255-268.

Internet Advertising Bureau. IAB Internet Advertising Revenue Report, 2001-2016 [URL: http://www.iab.com/insights/iab-internet-advertising-revenue-report-conducted-by-pricewaterhousecoopers-pwc-2/] accessed on Jan 19, 2018.

Jacoby, Larry L. (1978), "On Interpreting the Effects of Repetition: Solving a Problem versus Remembering a Solution," *Journal of Verbal Learning and Verbal Behavior*, 17(6), 649-667.

Janiszewski, Chris (1993), "Preattentive Mere Exposure Effects," *Journal of Consumer Research*, 20(3), 376-392.

Janiszewski, Chris, Hayden.Noel, and Alan G. Sawyer. 2003. A Meta-analysis of the Spacing Effect in Verbal Learning: Implications for Research on Advertising Repetition and Consumer Memory," *Journal of Consumer Research*, 30(1), 138-149.

Johnston, William A., Kevin J. Hawley, Steven H. Plewe, John M.G. Elliott, and M. Jann DeWitt (1990), "Attention Capture

by Novel Stimuli," *Journal of Experimental Psychology: General*, 199(4), 397-411.

Kimefeld, Yaakov M. and James H. Watt (2001), "The Pragmatic Value of On-Line Transactional Advertising: A Predictor of Purchase Intention," *Journal of Marketing Communications*, 7(3), 137-157.

Leong, Elaine K. F., Xueli Huang, and Paul-John Stanners (1998), "Comparing the Effectiveness of the Web Site with Traditional Media," *Journal of Advertising Research,* 38(5), 44-51.

Malaviya, Prashant and Brian Sternthal (1997), "The Persuasive Impact of Message Spacing," *Journal of Consumer Psychology*, 6(3), 233-255.

Manchanda, Puneet, Jean-Pierre Dubé, Khim Y. Goh, and Pradeep K. Chintagunta (2006) "The Effect of Banner Advertising on Internet Purchasing," *Journal of Marketing Research*, 43(1), 98-108.

Melton, Arthur W. (1970) "The Situation with Respect to the Spacing of Repetitions and Memory," *Journal of Verbal Learning and Verbal Behavior*, 9(5), 596–606.

Nagelkerke, N. J. D. 1991. A Note on a General Definition of the Coefficient of Determination. *Biometrika* 78(3), 691-3.

Noel, Hayden (2006), "The Spacing Effect: Enhancing Memory for Repeated Marketing Stimuli," *Journal of Consumer Psychology*, 16(3), 304-318.

Noel, Hayden and Beth Vallen (2009), "The Spacing Effect in Marketing: A Review of Extant Findings and Directions for Future Research," *Psychology and Marketing*, 26(11), 951-969.

Novak, Thomas P., Donna L. Hoffman and Yiu Fai Yung (2000), "Measuring the Customer Experience in Online Environments: A Structural Modeling Approach," *Marketing Science*, 19(1), 22-42.

Oberauer, Klaus and Stephan Lewndowsky (2008), "Forgetting in Immediate Serial Recall: Decay, Temporal Distinctiveness, or Interference," *Psychological Review*, 115(3), 544-576.

Pagendarm, Magnus and Heike Schaumburg (2001), "Why Are Users Banner-Blind? The Impact of Navigation Style on the Perception of Web Banners," *Journal of Digital Information*, 2(1) [URL: https://journals.tdl.org/jodi/index.php/jodi/article/view/36/38], accessed on Jan 19, 2018.

Pechmann, Cornelia and David W. Stewart (1988), "Advertising Repetition: A Critical Review of Wearin and Wearout," *Journal of Current Issues and Research in Advertising*, 11 (2), 285-330.

Pieters, Rik, Edward Rosbergen and Michel Wedel (1999), "Visual Attention to Repeated Print Advertising: A Test of Scanpath Theory," *Journal of Marketing Research*, 36(4), 424-438.

Pieters, Rik and Luk Warlop (1999), "Visual Attention During Brand Choice: The Impact of Time Pressure and Task Motivation," *International Journal of Research in Marketing*, 16(1), 1-16.

Raman, Niranjan V. and John D. Leckenby (1998), "Factors Affecting Consumers' Web Ad Visits," *European Journal of Marketing*, 32(7/8), 737-748.

Rundus, Dewey (1971), "Analysis of Rehearsal Processes in Free Recall," *Journal of Experimental Psychology*, 89(1), 63-77.

Schumann, David W., Richard E. Petty, and D. Scott Clemons (1990), "Predicting the Effectiveness of Different Strategies of Advertising Variation: A Test of the Repetition – Variation Strategies Hypothesis," *Journal of Consumer Research*, 17 (2), 192-202.

Schroeder, Will (1998), "Testing Web Sites with Eye-tracking," *User Interface Engineering—Eye for Design*, 5(5), 3-4.

Sherman, Lee and John Deighton (2001), "Banner Advertising: Measuring Effectiveness and Optimizing Placement," *Journal of Interactive Marketing*, 15(2), 60–64.

Terlep, Sharon, Suzanne Vranica, and Shayndi Raice (2012) GM Says Facebook Ads Don't Pay Off, Wall Street Journal, May 16 [URL: http://online.wsj.com/article/SB10001424052702304192704577406394017764460.html], accessed on Jan 19, 2018.

Toppino, Thomas C. and Mark A. Schneider (1999), "The Mix-Up Regarding Mixed and Unmixed Lists in Spacing-Effect Research," *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 25(4), 1071-1076.

Unnava, H. Rao and Robert E. Burnkrant (1991), "An Imagery Processing View of the Role of Pictures in Print Advertisements," *Journal of Marketing Research*, 28(2), 226-231.

Zhang, Ping (2000), "The Effects of Animation on Information Seeking Performance on the World Wide Web: Securing Attention or Interfering with Primary Tasks?" *Journal of Association for Information Systems*, 1(1), 1-28.

Zielske, Hubert A. (1959), "The Remembering and Forgetting of Advertising," *Journal of Marketing*, 23(1), 239-243.