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ABSTRACT: As with all forms of advertising, exposure is a necessary prerequisite for Internet banner ad effectiveness. However, exposure does not guarantee a user's attention, an issue especially relevant to the Internet, where ad avoidance occurs most frequently. And if an ad is noticed, the message may or may not remain in the consumer's memory after cognitive processing. However, even if the advertising message is not consciously remembered, the exposure can be unconsciously processed and subsequently change the user's affective state. To investigate how attention levels influence users, this study uses eye tracking to measure the level of attention that results from an advertisement exposure and explores how different levels of attention influence users in conscious and unconscious ways. Also, we examine the effect of animation—one of the most popular attention-grabbing tools—on attention and how it moderates cognitive processing.

By measuring and analyzing users' actual eye-movement data, we found that animation in banner ads not only attracts less attention than static ads but also reduces the positive effect of attention on memory. In addition, although more than half of the participants could not recognize the advertised brand, the animated banner ad was unconsciously processed and did influence attitudes toward the brand. The results suggest that animation in banner ads does not necessarily increase user attention, but that even if a user does not consciously notice a banner ad, the user's attitude toward the brand is influenced.

KEY WORDS AND PHRASES: Animation, attention, banner ads, eye tracking, Internet advertising effectiveness.

Spending for banner ads was projected to grow by $12.3 billion in 2011 and to reclaim the top online ad segment from search ads within a few years [16]. However, due to a disappointing click-through rate (CTR) of less than one out of one thousand Internet users, the effectiveness of banner ads has been questioned. The growth in banner ad spending, despite this very low CTR, implies that advertisers are beginning to understand that banner ads work like other types of advertising, which is to say that exposure itself even without a direct, immediate response may ultimately influence users' brand preferences and purchase choices.

However, exposure from the advertisers' standpoint must be distinguished from that from the consumers' standpoint [69]. Especially on the Internet, where ad avoidance occurs most frequently [14], a significant gap exists between advertisers' assessment of exposure and Internet users' assessment of exposure. In order for the advertised message to be perceived and memorized, gaining and preferably holding viewers' attention is required. Since attention is limited and selective [2, 67], not all the information on a Web page can be

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exposed and understood. Therefore, measuring attention rather than exposure more accurately estimates advertising effectiveness.

Attention alone, however, is not the whole story: people do not remember everything they notice [34]. Sometimes an advertising message is cognitively processed and remains in the consumer's memory, but at other times it does not. Clearly, a comprehensive investigation is needed to measure the level of attention banner ads garner and how the attention exerts influence on users' cognitive processing.

One of the most popular attention-grabbing tools employed in Internet banner ads is animation, which is known to make objects salient and stimulate higher levels of user involvement [20]. Paradoxically, animation may alert Internet users to the location of a banner ad, triggering ad avoidance behavior. In addition, animated ads are known to require more of the reader's cognitive resources than static images [25], resulting in weaker memory performance. A number of studies have shown that animation in banner ads is not an effective tool. According to these studies, animation either does not affect memory [3, 14] or worsens it [6, 25].

Considering these findings, the first objective of our study is to measure the effect of animation on actual attention to assess ad avoidance. The second objective is to investigate the effect of attention on memory moderated by the existence of animation from the cognitive resource perspective. Which leads us to the question: What happens when a banner ad is attended to but not perceived? Because Internet users are known to pay minimal attention to banner ads and devote minimal cognitive resources to ad processing [14], banner ads are more likely to be processed unconsciously [38, 69]. Thus, memory measures may underestimate the effect of banner ads. A number of studies have proved that in low-attention situations, advertising exposure is unconsciously processed and does affect viewers' judgment [38, 41], attitude [19, 69], or ad evaluation [53]. Does the unconscious effect occur without any attention at all? Does more attention, even when not acknowledged, have a positive or a negative effect? With these questions in mind, the third objective of our study is to investigate the unconscious effects of attention with actual attention data, which has not been studied empirically before.

For an advertising message to be most effective, both consumer attention and cognitive processing are equally important [21, 40]. However, many studies investigating memory-based cognitive processing assume salient stimulus and repetitive exposure naturally result in attention [66]. Yet recent studies find that it is difficult to gain and hold the attention of consumers in competitive advertising environments [67]. The importance of attention in a world of advertising overload cannot be overemphasized. Therefore, our study focuses on how animation in banner ads influences attention by actually measuring users' attention with an eye-tracking device and how this attended advertising message is memorized from the cognitive-processing perspective. Furthermore, we investigate how attention without conscious perception exerts an unconscious influence on a user's affective state.

The rest of this paper is organized as follows: We examine the theoretical background and present the research hypotheses. Then, we describe the research method and experimental procedure. Next, we report, analyze, and

discuss the results of the experiment. We conclude with suggestions for future research.

Theoretical Background and Hypotheses

Selective Attention and Executive Functions

Because attention is limited and selective, only a portion of the information on a Web page attracts people's attention [40, 66, 67]. The directing of attention is influenced by both bottom-up and top-down factors. It has been proven that larger, brighter, and faster-moving objects or a unique object among homogeneous distracters can be found more easily [60]. This behavior is attributed to bottom-up factors, whereby attention is automatically shifted toward salient visual features. However, attention is not entirely responsive; people can voluntarily guide their attention in accordance with their objectives. These internal goals and intentions are known as top-down factors and are closely related to executive functions [10, 58, 66]. Executive functions are the high-level cognitive processes that are invoked in situations when automatic processing does not suffice and are considered to be closely related to cognitive controls such as selective attention, behavioral inhibition, and goal-directed behavior [18, 39]. According to this theory, neural pathways between an attention-grabbing stimulus in the external environment and the corresponding response are established innately or gradually with experience, and the behavior of paying attention to that stimulus is automatically elicited (bottom-up control). However, when this behavior conflicts with people's internal goals, top-down control is needed to willfully bias their attention toward a goal-relevant stimulus that is in competition with a stronger but goal-irrelevant stimulus, and this is when the executive functions are invoked in order to override this otherwise automatic bottom-up processing [39].

Inattention to Animated Banner Ads

Although advertisers cannot control top-down factors, they can manipulate bottom-up factors to increase stimuli salience in the hopes of catching users' attention. Banner ads compete with editorial content as well as other banner ads, so advertisers have employed a variety of attention-grabbing tools, such as large size, vivid colors, and animation. Among these tools, animation is the most common, and it has received much attention from academics and practitioners [12, 25, 57].

The attention-attracting aspect of animation is supported by motion effect theory, which claims that human beings tend to quickly direct their attention toward moving objects and process the relevant information because they regard moving objects in their peripheral vision as either threats or opportunities [51]. Despite the inherent attention-attracting aspect of animation, different users pay different amounts of attention to the same animated banner ad because attention is determined by top-down factors as well as bottom-up

factors. Top-down factors are particularly relevant to Internet users because Internet users have been found to be more goal oriented [7] and to judge online advertising more negatively than users of other media [36]. Furthermore, online ads that are embedded in editorial content are not Internet users' main interest. Therefore, attention is challenged when an Internet user whose goal is to read editorial content rather than watch an advertisement (negative top-down factor) faces a banner ad equipped with attention-grabbing animation (positive bottom-up factor). Because Internet users are frequently in this situation, investigating the actual attention paid to banner ads should generate valuable insight into users' behavior.

According to executive function theory, it is initially necessary to elicit executive function in order to select goal-relevant objects against strong, goal-irrelevant objects; however, repeated selection will strengthen the pathway from stimulus to response and ultimately automate the response [39]. Likewise, in the context of Internet advertising, users learn to assume an animated picture embedded in editorial content is a banner ad by past experience, that is, even though animation is the important attention-grabbing tool supported by motion effect theory, Internet users tend to develop a negative response to banner ad–like objects, according to the executive function theory. This may enable users to automatically avoid paying attention to animated banner ads, contrary to advertisers' expectations. Fixation duration and fixation frequency are the most commonly used measures of attention [46], and we propose the following hypotheses based on the preceding discussion:

> ***Hypothesis 1:*** *Attention to an animated banner ad is lower than attention to a static one.*
>
> ***Hypothesis 1a:*** *Fixation frequency to an animated banner ad is lower than fixation frequency to a static one.*
>
> ***Hypothesis 1b:*** *Total fixation duration to an animated banner ad is shorter than total fixation duration to a static one.*

Attention and Memory

In order for an advertising message to achieve its goal of consumer persuasion, attention alone is not enough; consumers must process what they have seen [65]. However, without attention, no further processing can occur to influence subsequent consumer decision making. Correspondingly, more attention leads to more opportunity to encode and store messages, and a positive relationship between attention and memory has been found by a number of eye-tracking studies [19, 27, 37, 47].

In addition, it can be inferred from the methodology employed in a number of ad repetition studies [29, 68] that more attention will yield higher memory performance: users were required to fix their gaze on the advertising in most experiments. Therefore, in conjunction with H1, claiming that banner animation depresses attention levels, we hypothesize a positive correlation between attention and memory, which will complete our analysis of the effect of

animation on memory through attention. Therefore, we can logically propose the following hypothesis:

> ***Hypothesis 2:*** *More attention to a banner ad leads to better memory performance.*
>
> ***Hypothesis 2a:*** *More banner ad fixation frequency leads to better memory performance.*
>
> ***Hypothesis 2b:*** *More banner ad total fixation duration leads to better memory performance.*

Moderating Role of Cognitive Load

Once users pay attention to the marketing message, their cognitive and affective processes are triggered. This results in changes in their behavior as well as in their psychological state, including memory, attitude, and preference [5]. Wedel and Pieters [67] showed that all these processes occur simultaneously with and are accurately reflected in users' eye movements; hence, it is said that attention contributes strongly to the effectiveness of advertising [66, 67]. The information gleaned from attention, however, is not all translated into memory; the amount of information far exceeds what users' brains can process [66]. According to theories of limited capacity [2, 34], people have limited cognitive resources, which are allocated to each task depending on the available resources and the user's intention to process a message. Every cognitive task requires a certain level of resources, and the amount depends on both the task's complexity and the person's experience with the task. For successful message processing, the resources allocated must meet the demand.

Internet users tend to devote minimal resources to processing banner ads. If the advertisement itself requires too many cognitive resources to interpret, resources will be lacking for further message processing, such as encoding and storing, which are the necessary steps for memory [34]. Animated banner ads, which present new information in each frame, require more cognitive resources than static banner ads. Therefore, we hypothesize that even among users who pay the same amount of attention, memory performance will vary depending on animated ad versus static ad exposure. In light of the preceding discussion, we propose the following hypothesis concerning the moderating role of animation's heavy cognitive load (i.e., the complexity of the message).

> ***Hypothesis 3:*** *A banner ad requiring more cognitive resources reduces the positive effect of attention on memory.*

Attention and Attitude: Mere Exposure Effect

Internet banner ads share space with editorial content and occupy only a small fraction of the screen, but Internet users perform mostly goal-oriented tasks: reading news, looking for information, and socializing. Thus, Internet

banner ads are considered to be a classic example of unconsciously processed messages, and Internet users are likely to be faced with persuasion in a very-low-involvement situation [38].

Traditional theories have not addressed persuasion in this very-low-involvement situation. The elaboration likelihood model, one of the most widely adopted persuasion models, proposes that consumers follow a central route in a high-involvement situation and a peripheral route in a low-involvement situation. A central route requires extensive elaboration of the information, resulting in a large amount of cognitive-processing effort, whereas a peripheral route involves a meager amount of elaboration, resulting in less processing effort [44]. As such, persuasion was once viewed as the function of a consumer's cognition of the message content [38]. However, in a very-low-involvement situation, where consumers pay little attention to advertising and cognitive capacity is severely constrained, persuasion occurs without cognition [72]. Mere exposure effect is frequently proposed to explain attitudinal changes that occur when ad exposure is so brief that its presence is hardly recognized. This theory suggests that brief and repeated exposure to a stimulus can encourage people to have familiarity and a more favorable attitude toward that stimulus at an unconscious level, that is, even when they cannot recollect being exposed to it [33, 71]. As such, affect and cognition are proved to be processed independently [72], and a number of studies have shown this unconscious effect of exposure [8, 17, 19, 35, 54]. Because mere exposure effect tends to emerge in a low-attention situation [22, 70] and the influence of incidental mere exposure is stronger when subjects are not aware of the exposure [4], the level of attention has been proven to be negatively associated with attitude [19]. More specifically, Bornstein and D'Agostino have shown that attitude toward the merely exposed stimulus is higher when exposure durations are shorter and exposure frequency is higher, whereas longer exposure weakens attitude but increases recognition [5]. Taken together, we propose the following hypotheses:

> ***Hypothesis 4:*** *Users with more frequent attention have more favorable attitudes toward the advertised brand.*
>
> ***Hypothesis 5:*** *Users with longer attention duration per attention have less favorable attitudes toward the advertised brand.*

All the hypotheses are summarized in Figure 1.

Methodology

Stimuli

Both static and animated versions of target banner ads were created. Animated ads were set at two different speeds to check whether animation speed has any effect on attention. The slow version consisted of four scenes per four seconds, and the fast version consisted of ten scenes per four seconds; in both cases each scene contained new information. One of the scenes from the

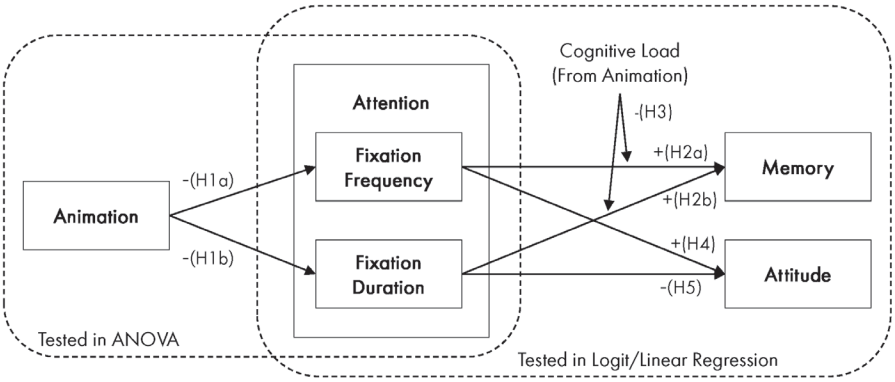

Figure 1. Research Model with Hypotheses

animated version was employed in the static version to ensure that the static version required less cognitive load than the animated version. All versions the contained both text and graphics: text for the brand name and graphics for the advertised product and related items. Figure 2 shows some examples of banner ads.

Three different ads were designed for each animation speed to eliminate ad-specific effects, which led to a total of nine target ads. Three common product categories—toothpaste, coffee, and shampoo—were selected for the target ads [1, 41]. To eliminate the effects of brand familiarity, fictitious brand names were used. These names were chosen after a pretest ensured brand name neutrality in both meaning and attitude.

The participants were exposed to one out of nine target ads while going through 20 Web pages. These pages were developed to be a replica of one of the most popular online news portal sites. Twenty news stories about health, travel, and cultural information were selected, and each Web page contained one of these news stories accompanied by one banner ad on the upper right side. Eight pages out of the 20 contained one of the target ads, and the other 12 pages contained one of the filler ads created for this experiment. To guarantee the salience of the banner ad, the banner ad was the only graphic on an all-text page. Order of banner ad exposure was randomized across participants, and target ads never appeared first or last, so as to reduce primacy and recency effects, respectively. The same ads were not shown to viewers consecutively, but separated by at least one different banner ad.

Twenty news stories were randomly paired with either target or filler ads; each combination made one set, and other sets of news story–banner ad combinations were formed to avoid any news story–specific effects and to achieve generalization.

Participants and Procedure

One hundred and eighteen men and women from a business school voluntarily participated in the experiment; each received a lunch coupon in return.

Figure 2a. Example of a Static Banner Ad

Figure 2b. Snap Shots from an Animated Banner Ad

Participants were randomly assigned to one of the three animation speeds (fast, slow, or static) and instructed to read 20 news pages as they normally would while reading online news. The task was given to ensure that their attention was under control of the top-down factors and their cognitive resources were occupied [26] by the task, meaning that there would be less attention and fewer cognitive resources available to the participants.

When going through news pages, participants could progress at their own pace by pressing a "Next Page" button at the bottom of each page. Unlike participants under forced-exposure conditions, in which they are asked to pay attention to the advertising for a certain amount of time, participants under this type of free-viewing condition are expected to pay little attention to banner ads [66]. Therefore, to ensure that enough attention data were collected, the same target ad appeared 8 times as participants went through the 20 news pages. Some of the filler ads were repeated as well so that the target ad was not the only one appearing repeatedly.

The experiment lasted approximately 20 minutes. Attention data were collected while participants viewed online news pages, but the participants were not informed of this until the experiment was finished. Immediately following the experiment, participants were instructed to fill out a paper-and-pencil questionnaire for memory, brand attitude, and demographic data collection.

Eye-Tracking Methodology

The most common approach for measuring the amount of attention paid to advertising is to use self-reported memory measures by asking questions such as "To what extent do you pay attention to the ads?" [40]. However, memory measures are a poor metric for measuring consumers' attention to advertising [52]. Citing the problem of memory measures, Molosavljevic and Cerf [40] argued that there are at least two problems: either a stimulus is attended to but the awareness stage is not reached, making it impossible to keep the stimulus in the memory and report it, or even when a stimulus is stored in the memory, people may forget it, along with most of the stimuli they have processed. Thus, to avoid the problem of memory measures, physiological responses such as eye movements, which are tightly linked to shifts in attention [11, 67], are considered more reliable indicators than self-reporting or memory measures [31, 63]. In addition, findings from cognitive psychology hold a great deal of promise for advertising research [62]. To show how cognitive processes work in various information-processing conditions [50], many eye-tracking studies have been conducted in the fields of information systems [6, 9, 14, 23, 42] and marketing [45, 46, 65].

For collecting data on eye movement, an eye-tracking device is needed. A Tobii T120 (Danderyd, Sweden) was used in this study. This device uses infrared light to illuminate viewers' eyes, the resulting reflections are picked up by infrared sensors on the monitor, and the software then uses these data to estimate eye position [13, 59]. Eye movements are collected with 120 Hz frequency (or every 8.3 milliseconds) and then processed to calculate eye fixation frequency and duration. The Tobii T120 can identify where users are gazing within less than a centimeter's accuracy [59]. Furthermore, it does not require participants to mount any device on their head or eyes and looks like a normal computer monitor, which allows for an unobtrusive and natural environment in which to measure eye movement.

Measures

Attention

An eye-tracking device can measure fixation frequency (i.e., number of eye fixations on target stimuli), fixation duration (i.e., total duration of eye fixation on target stimuli), scan path (fixation sequence), location of the first fixation, time of the first fixation, and so forth [15]. Because our interest is in processing intensity at a specific location, fixation duration and fixation frequency were chosen for the measurement [66].

Memory

Memory has been measured with recall, cued recall, and recognition in many studies. Among these, recognition has been proven to be sensitive and

discriminating enough when assessing memory [55] and is considered superior to recall and cued recall [43]. Furthermore, recall is reputed to underestimate the effect of exposure in measuring ad effectiveness in low-involvement situations [32]; thus, recognition was chosen to measure memory.

Recognition data were collected via questionnaire; participants were presented with four choices and asked to choose one banner ad they recognized from the experiment. The brand names of the distracters used in the choices were pretested for equivalent meaning: name familiarity, benefit associations implied by the name, and overall quality perceptions [1].

Attitude Toward a Brand

Attitude toward the advertised brand was collected via questionnaire and assessed by averaging the scores of five nine-point measures: likable/unlikable, unpleasant/pleasant, appealing/unappealing, attractive/unattractive, and bad/good [17, 28].

Results

Effect of Animation on Attention

As stated in H1, we expected that attention paid would be lower for animated banner ads than for static ads. The effect of animation on attention was tested with a one-way ANOVA (analysis of variance) employing total fixation duration and fixation frequency as dependent variables. A significant main effect of animation on fixation frequency ($F(2, 115) = 5.410$, $p < 0.01$, $\eta^2 = 0.08$) and total fixation duration ($F(2, 115) = 5.948$, $p < 0.01$, $\eta^2 = 0.09$) emerged, and therefore H1a and H1b were supported (see Table 1). Static ads drew users' eyes more frequently and for longer periods of time than ads with either slow or fast animation. A post hoc test (Bonferroni test) showed a statistically significant difference between static ads and animated ads for both fixation frequency and total fixation duration, but no difference between slow animation ads and fast ads. The Duncan test also divided the animation speed into two homogeneous subsets: one consisting of static ads and the other of slow or fast animation ads.

Effect of Attention on Memory and Moderating Effect of Cognitive Load from Animation

We hypothesized in H2 that more attention to a banner ad would result in better memory performance and in H3 that animation would reduce the positive effect of attention on memory. Because of the dichotomous nature of the recognition scores, we ran a logit regression using total fixation duration, fixation frequency, and their interaction terms with animation as independent variables and recognition as a dependent variable. Animation took on the value

Table 1. Means and Standard Deviations for Total Fixation Duration and Fixation Frequency.

Animation speed	Total fixation duration	Fixation frequency
Static	6.87	24.84
	(6.10)	(22.61)
Slow	3.51	12.86
	(3.92)	(13.61)
Fast	3.64	14.23
	(4.50)	(15.61)

Note: Numbers in parentheses are standard deviations.

of 0 for static ads and 1 for animated ads. As shown in Table 2, participants' recognition was positively affected by total fixation duration ($p < 0.01$) but not by fixation frequency ($p > 0.2$), so H2b was supported but H2a was not. As indicated by the negative coefficient of the interaction of animation and total fixation duration in Table 2, animation weakened the effect of total fixation duration on recognition ($p < 0.05$). Thus, H3 was supported. Since fixation frequency did not have a significant effect on recognition, the moderating effect of animation on this relationship is not considered.

To determine whether visual attention fully mediated the relationship between animation in banner ads and viewers' memory, we conducted an additional binary logistic regression using a bootstrapping technique [48]. Recognition was entered as a dependent variable, animation as a predictor variable, and total fixation duration as a mediator. The result revealed that the total effect of animation on recognition (total effect = –0.77, $p < 0.05$) became not significant when the total fixation duration mediator was included in the model (direct effect of animation = –0.36, $p > 0.3$). A bootstrap analysis showed that the 95 percent bias-corrected confidence interval for the size of the indirect effect excluded zero (–1.20, –0.18), indicating that there exists a significant indirect effect [48]. Thus, we can say that total fixation duration fully mediated the relationship between animation and recognition.

Effects of Attention on Brand Attitude

In H4 and H5 we hypothesized a positive effect on brand attitude from frequent attention and a negative effect on brand attitude from longer attention duration per attention. Since fixation duration per each attention matters in these hypotheses, rather than total fixation duration, we used the average of all the fixation durations for the analysis.

To test H4 and H5, we conducted a regression analysis with average fixation duration and fixation frequency as independent variables and attitude toward the advertised brand as a dependent variable. Because mere exposure effect was shown to emerge when the exposure is not acknowledged [72], this analysis was conducted with data from participants who did not recognize

Table 2. Logit Regression Results: Attention on Recognition.

	Total fixation duration	Fixation frequency	Animation	Animation x total fixation duration	Animation x fixation frequency
Coefficients	0.99	-0.12	0.77	-0.89	0.11
p	0.01	0.20	0.11	0.03	0.34

Table 3. Regression Results: Attention on Attitude (*N* = 68)

Variable	*B*	SE(*B*)	ß	*t*	Sig. (*p*)
Average fixation duration	-4.08	1.60	-0.28	-2.55	0.01
Fixation frequency	-0.05	0.01	0.45	4.06	0.00
$R^2 = 0.228$.					

the banner ads to which they were exposed ($n = 68$). The results are shown in Table 3 ($R^2 = 0.228$, $F(2, 66) = 9.76$, $p < 0.01$). The negative coefficient of the average fixation duration ($p < 0.01$) and the positive coefficient of fixation frequency ($p < 0.01$) support H4 and H5.

Summary of Results

Our study examined the following: (1) the effect of visual stimuli (animation) on attention; (2) the effect of various attention measures (total fixation duration, average fixation duration, and fixation frequency) on both memory (recognition) and attitude change; and (3) the moderating role of banner ads' cognitive requirement (animation). The results are summarized in Figure 3.

In this experiment, the argument that people instinctively pay attention to visually salient stimuli did not hold true. Animated banner ads attracted less attention than did static ads. The results of our eye-tracking study offer an explanation for why animation in banner ads elicited worse memory performance in past studies [3, 6], that is, it can be inferred from our study that most Internet users employ executive functions to avoid visual objects that are distinct from editorial content, regarding them as irrelevant to their goal. In addition, animation speed itself did not make any difference in users' ad avoidance behavior. This suggests that users have a tendency to avoid animated objects regardless of the speed while surfing on the Web.

Evidence for an effect of attention on memory was found—the longer users pay attention to a banner ad, the better their recognition performance. However, only total fixation duration, not fixation frequency, influences recognition performance. This implies that there is little difference between one eye fixation with long gaze duration and a number of short fixations in terms of recognition performance.

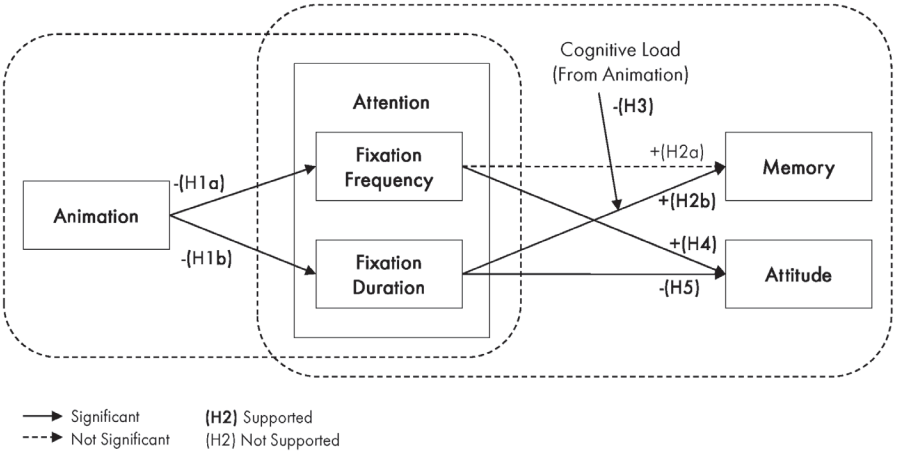

Figure 3. Summary of Results

The moderating role of cognitive load required by animated banner ads was also found. Because of users' limited cognitive capacity, animation in banner ads negatively affects the relationship between attention (total fixation duration) and memory. Therefore, users may not be able to recognize a visually complex banner ad, despite attention paid, because of the extra cognitive resources required for processing the ad.

Although more than half the participants could not recognize the advertised brand, the banner ads imprinted unconsciously caused attitudinal changes. This study supports the mere exposure effect by showing that frequent eye fixation improved participants' attitude toward the advertised brand, whereas longer average fixation duration had a negative effect on attitude.

Discussion and Conclusion

In this study we aimed to investigate Internet banner ad processing and effectiveness from start to finish. Initially, we measured attention paid during exposure to a message; next we assessed subsequent cognitive processing; and finally, we analyzed the conscious and unconscious effects of attention. Specifically, by utilizing a modern eye-tracking device, we collected actual attention data from participants viewing the Internet at their own pace in a natural setting. Findings from self-controlled exposure settings are considered more reliable than those from forced-exposure settings, especially in the case of advertising in very-low-involvement situations such as banner ads [40, 49].

Despite increasing understanding of the importance of attention in studying consumers' information processing, surprisingly little research exists on this subject [56]. A number of researchers have pointed out the need for additional research on the role of visual stimuli in attracting attention [24, 30], particularly in the context of Internet advertising, where static and dynamic visual features are combined [66, 67]. From this study, by directly measuring and analyzing

actual attention to banner ads, we can draw several interesting conclusions. First, we found that animation, the Internet's most popular attention-attracting tool, drives user attention away. These findings confirm that, with the help of executive functions, people are able to cognitively control their attention, selecting goal-relevant objects over attention-grabbing stimuli. Second, we found that various attention measures—specifically, fixation frequency and fixation duration—have different effects on cognitive processing and subsequent attitudinal changes. This would not have been uncovered without measuring the actual attention. Third, we found that when banner ads are attended but not remembered, they still can influence users in an unconscious way. Eye-tracking data show that in natural exposure conditions many Internet users pay very little attention to the banner ads. This means that banner ads are placed in a mere exposure situation contrary to advertisers' desires. However, when repeated, very brief eye fixations did change users' attitudes even when exposure was hardly recognized. Consequently, we verified the mere exposure effect in the context of banner ads. These findings are particularly meaningful, since most Internet users spare little to no attention and cognitive resource on banner ads.

From a practical perspective, several strategies for banner ads can be derived from the results of this study. First, advertisers should pay careful attention when using animation in banner ads because animation may repel users' attention and hinder the cognitive processing of the exposed message. Second, since fixation frequency and fixation duration have different effects, advertisers should adopt different strategies according to their objectives. If brand recognition is the main purpose of the advertisement, then only fixation duration matters and advertisers should try to extend the total fixation duration either by holding users' attention as long as possible or by catching their attention as often as possible. However, if a positive change toward brand attitude is the main purpose, they should try to attract users' attention frequently without holding attention too long. Therefore, for the same total fixation duration, it would be more effective to attract attention with many short frequencies rather than a few longer frequencies for both better memory and favorable attitude. Advertisers should also be aware that even when users do not recognize—or do not notice the existence of—a banner ad, it can still have an effect on users' subsequent behaviors via unconscious influence.

This study has a couple of limitations. First, even though the experimental situation was closer to real-life Internet use than experiments conducted in a forced-exposure situation, the experiment was conducted in a laboratory setting, and consequently the findings have limited potential for generalization. Second, when testing the unconscious effect of attention on attitude toward the brand (H4 and H5), 68 samples were used, which is not a large enough sample size for a regression analysis. Although this was an inevitable result of ensuring that only the unconscious effect was taken into account, additional research with a larger sample size could generate more robust results. Third, some variables that might be related to subjects' news-reading behavior were not strictly manipulated. By asking about and controlling their involvement in reading online news as well as their prior Internet usage experience, the results could have been more reliable.

There are several areas that warrant further research. It is known that repetitive exposures can easily engender irritation and subsequently influence users' attitudes toward an advertisement [61]. Related topics to investigate include (1) the relationship between eye-movement pattern and the feeling of irritation and (2) the moderating role of irritation on the unconscious effect of attention on attitude. In addition, it has been shown that task type on the Internet, that is, information search versus online shopping, for example, affects behavioral responses to advertising [64]. This study employed only one task type (news reading); thus, further research on how different tasks affect Internet users' behavior is warranted.

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