Exploring Effective Advertising Strategies: The Roles of Formats, Content Relevance and Shopping Tasks on Ad Recognition

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EXPLORING EFFECTIVE ADVERTISING STRATEGIES: THE ROLES OF FORMATS, CONTENT RELEVANCE AND SHOPPING TASKS ON AD RECOGNITION

Completed Research Paper

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Abstract

The widespread application of Web-based technology has contributed not only to the content of advertising but also to the improvement of presentation formats. Animation has become a powerful presentation format on the Web. Despite its potential benefits, however, animation is no panacea. Practitioners and academics have been paying increased attention to the exploration of effective advertising strategies in the e-commerce environment. Drawing on theories in cognitive psychology, this study, by using a laboratory experiment, investigates the roles of presentation formats, content relevance and shopping tasks on ad recognition. The results show that abrupt and looming formats are effective formats in improving ad recognition. There is a significant three-way interaction between the formats, content relevance and shopping tasks on ad recognition. Specifically, the interaction effect of animation formats and content relevance is observed in browsing tasks, but not in searching tasks.

Keywords: Presentation formats, content relevance, shopping tasks, ad recognition
Introduction

With the growth of Web technology tools (e.g., plug-ins, Flash), animation has become one of the favorite presentation formats used in Internet advertising. From the point of view of both Web designers and advertisers, animated advertising provides more powerful visualization cues than any other formats used to attract users’ attention, and consequently increases their click stream, and ultimately their buying behavior (Gonzalez et al. 1997; Yoo et al. 2005).

Despite the potential benefits, however, animation is no panacea. Prior research on animation has indicated a contradiction of terms. On the one hand, some studies suggest a magically positive function of animation, in terms of enhancing users’ attention and recall performance (Hong et al. 2004; Kalyanaraman et al. 2001; Li et al. 1999; Zhang 2000). On the other hand, animation is also regarded as an irritating and annoying artifact (McGalliard 1998). It is a typical experience for online users to be interrupted by the abrupt appearance of animations (Zhang 2000).

Hence, there are many situations where animation may actually be counterproductive. With the extensive adoption of Web animation technology in the e-commerce environment, it is necessary to identify the relevant contingent factors, in order to better understand its influence. As Lim and Benbasat (2000) noted, the new challenge is to develop a set of guidelines and strategies as to how and when to use the array of tools available (e.g., video, animation). This study attempts to explore effective advertising strategies, by discerning how and when to use animation appropriately.

The first objective of this study is to conceptualize and compare the different animation formats. Although previous IS literature has greatly contributed to our understanding of the various roles of animation, animation is generally treated as a unitary concept, without systematically differentiating the various types of motion (Hong et al. 2004; Zhang 2000; 2003). For example, animation is defined as any kind of motion (Zhang 2000). However, evidence from vision research has indicated that not all kinds of motion capture attention (Abrams et al. 2003; Yantis et al. 1996). At the same time, web-based technologies have made numerous kinds of animation on the Web possible. Therefore, in order to recognize and differentiate between the motion formats, this study aims to fill the research gap by extending the conceptualization of animation to include four distinct formats: Abrupt, continuous, looming and receding.

The second objective of this study is to examine how to deliver the different animated formats so as to more appropriately fit with the content factors. To achieve this, we try to explore the relationship between animation and content relevance. In the real e-commerce environment, many factors operate simultaneously on the same computer screen. Hence, the effect of animation rarely occurs in isolation without depending on these factors. It is found that the current “fashion” in advertising is content relevance. It is common practice to have websites interact with consumers by delivering personalized services, among which content relevance is most widely adopted on Internet advertising. Specifically, Internet Content Providers tend to use content-based analysis to detect consumers’ interests or processing goals, and then to deliver relevant messages to them in real time (Ho et al. 2005; Tam et al. 2005; 2006). Yet empirical research on the effect of combining formats and content has been scarce, hence little is known about how animation formats and content relevance influence each other in an e-commerce environment. Therefore, this study contributes to previous literature by adding the content relevance variable into the contingency models of animation.

Finally, this study aims to investigate how the triadic relationship between the formats, content relevance and shopping tasks affects ad recognition. As is already known to us, the ultimate goal of an e-commerce service is to deliver the right format with the right content to the right users (Tam et al. 2005; 2006). To achieve this goal, online users’ shopping tasks need to be taken into consideration. Previous studies have identified are two distinct online shopping tasks: Searching and browsing (Janiszewski 1998; Li et al. 1999; Novak et al. 2003). Users in searching tasks are goal-oriented, with an identified task and actively seek specific information; whereas users in browsing tasks are less goal-oriented, with no specific targets, and usually just browse a website (Hong et al. 2005). In order to obtain a comprehensive understanding of the effects of animation, this study investigates the relationship between different formats, content relevance and shopping tasks on ad recognition.
Theories and Hypotheses Development

Presentation Formats of Animation

Animated versus static ads

IS literature has defined animation as any kind of motion (Zhang 2000; 2003). Motion, as one of the fundamental attributes of the physical world, usually indicates threats or opportunities to human beings in adaptive behaviors. Motion effect theory, which assumes that human beings have an inherent sensitivity towards moving objects (Reeves et al. 1996), has been extensively applied in explaining the underlying mechanisms of animation. When moving images are displayed on the Web, users tend to shift their attention to the source of the motion (Diao et al. 2004). Moreover, empirical marketing studies have also supported the effect of animated advertising on consumers’ cognitive processes, such as a stronger attention capture capability (Li et al. 1999). Hence, it can be expected that it is the property of motion that distinguishes animated ads from static ones, attracting users’ attention and thereby improving users’ recognition performance. The research model for this study is presented in Figure 1.

From the perspective of cognitive psychology, when objects receive more attention, they are better processed in terms of increased depth memory trace (Beck et al. 2005). Since the relationship between greater attention allocation and better recognition performance has been well established, recognition has usually been used as an indicator of attention by many researchers. Additionally, ad recognition is very meaningful and important for online practitioners, because both higher attention capture and recognition are important advertising goals. Therefore, in this study we adopt ad recognition as the criterion for testing the effects of animation, and we hypothesize the following:

**H1:** advertising in an animated format will lead to higher ad recognition than that in a static format.

Figure 1. Research Model

Abrupt versus continuous ads

One important characteristic of motion is the continuity of movement. In the physical world, an object can move discretely or continuously (Abrams et al. 2003; Yantis et al. 1996). Animations with abrupt motion versus continuous motion are distinguished both in their manner of display and their functions. In the web environment, *abrupt motion format* refers to animation that suddenly begins to move from a previously static state, the onset of motion following a preexisting static object, for example, ad starting to move after several hundred milliseconds of being static; whereas *continuous motion format* refers to animation that moves continuously and smoothly without any abrupt start or stop.
In the e-commerce environment, advertising in a sudden appearance is usually considered to be a powerful ad format for attracting users’ attention. According to the object-based theory of visual attention (Duncan 1984; Kahneman et al. 1992), allocation of attention is based on objects. When a new stimulus appears in the vision, a corresponding “object” is created, which in turn leads to allocation of attention to this new object. The process of attention allocation to the “new” objects carries an adaptive advantage, because “new objects are likely to have behavioral significance and require rapid response” (Yantis et al. 1996). Psychological literature has provided ample evidence in support of the effective impact of abrupt motion on attention priority. Some studies have found that the onset of motion in a previously existing static object can attract users’ attention (Abrams et al. 2003). Yet no attention bias towards continuous motion has been reported (Yantis et al. 1999).

We hypothesize that the rationale of attention bias toward abrupt motion can be applied to advertising in practical e-commerce settings. Advertising on the Web using abrupt motion generates a sudden change in an online user’s visual field, thus creating a new representation for advertising, and requiring an immediate response. Previous studies have been conducted in well-controlled labs that bear no relevance to a practical e-commerce environment. In this study we will test whether or not advertising using abrupt motion is processed more preferentially than advertising using continuously-moving or static formats. We hypothesize the following:

**H1a**: Advertising in an abrupt motion format will lead to higher ad recognition than that in a continuous motion format.

### Looming versus receding ads

Besides continuity of motion, changing size of animation is another important feature of animated ads. In the visual world, the size of an object is a primitive cue to signal its importance. Since larger objects usually attract more attention than smaller ones, it can be inferred that ads of a larger size may be more effective. Some designers believe that changing size may be an effective design for capturing users’ attention. For example, Microsoft’s new operating system, Windows Vista, has adopted changing the size of objects (e.g., files, folders) in its user interface design. It is thought that an approaching file, whose size increased dynamically on the computer interface, helps a user efficiently identify the object and accomplish the subsequent task. Similarly, animation with a changing size is thought to be an effective design in advertising.

In this study, we will also explore the effect on recognition performance of animated ads in the format of changing size. Specifically, we will examine two types of animated ads that use a changing size: **Looming motion format** and **Receding motion format**. Looming format refers to animated advertising where the size is increasing dynamically on the webpage, i.e., advertising where the size expands in a manner that makes it look as though it is coming towards the user’s eyes. Receding format refers to animated advertising where the size is decreasing on the webpage so that it appears to move away from the user’s eyes. According to the literature on cognitive psychology (Franconeri et al. 2003; Lee 1976; Wang et al. 1992), looming objects are more powerful than receding ones in attracting attention. The underlying mechanism may be understood from the behavioral urgency theory, which states that the object that is approaching can trigger a behavioral urgency that in turn may produce an information processing priority (Wang et al. 1992). Hence, in an e-commerce setting, advertising in a looming format can be expected to generate more attention priority than that in a receding format, because objects in a person’s vision using a looming format stimulate urgency for attention. Therefore, we hypothesize the following:

**H1b**: Advertising using a looming format will lead to higher ad recognition than that using a receding format.

### The Moderating Role of Content Relevance

In the marketing field, relevance is an effective strategy for the product promotion. For example, a store selling CDs may also provide certain related products, such as earphones or CD writers, so as to entice consumers to purchase additional products. Relevance has been thought of as the ‘fundamental and central’ concept in information science (Schamber et al. 1999), prior literature has shown the importance of relevance (Saracevic 1975). The development of information technology (IT) has made it possible for e-commerce websites to interact with customers with the strategy of relevance. **Content relevance** is defined as the degree to which the advertising content is relevant to the content of the webpage in which it is embedded. (Tam et al. 2006). Many e-commerce websites currently use content-based analysis to target users’ interests and to deliver, in real time, advertising that is relevant to consumers’
processing goals (Tam et al. 2006). For instance, Google AdSense crawls the website content automatically, and delivers advertising that is relevant to the content of the webpage.

We argued that the effect of different formats cannot occur in isolation without interacting with other factors. One of the most important factors that may influence the effectiveness of advertising could be the ad’s relevance to the content of the webpage in which it is embedded. The elaboration likelihood model (Petty et al. 1986) stipulates that elaboration of a message (e.g., advertising) takes place via two routes: A central route and a peripheral route. The central route, which usually results in a higher level of elaboration in cognitive processing, is used when users are motivated to scrutinize a message, but users will receive peripheral cues when they are not motivated (Tam et al. 2005; 2006). This generalized rationale can be applied to a practical e-commerce environment. Despite the large amount of information conveyed by animation, the information can be prioritized and processed at the pre-attentive level (the early stages of attention), because of their conspicuousness for capturing attention (Drèze et al. 2003). However, whether or not this information can be further processed at the users’ attention stage depends on both the salient effect of the stimulus itself and its relevance to the processing goal, as suggested by Theeuwes (1990). Empirical studies have found that salient objects are more likely to attract attention merely when they were relevant to users’ processing tasks (Yantis et al. 1999). We think that in online shopping tasks, when users are aware that the content of advertising is relevant to their current shopping goals, they are more likely to be motivated to scrutinize the content of the advertising. As a result, advertising information can be elaborated via the central route of cognitive processing, which in turn may lead to better performance in memory.

In contrast, for advertisement that is irrelevant to the content of the webpage, it can be expected that the standout effect of animated advertising may not appear. As argued by Zhang (2000), irrelevant animation can reduce users’ attention, because it distracts users’ attention from their primary tasks. Users require additional attention capacity to cope with the distraction and interference derived from irrelevant animated advertising. According to the elaboration likelihood model (Petty et al. 1986), when users are not motivated or are unwilling to exert cognitive effort to further scrutinize any content-irrelevant advertising, they will rely on a peripheral route, resulting in a low level of elaboration. The lowering of elaboration will reduce the cognitive effort put into processing the advertising, and this will consequently lead to lower recognition performance. In summary, in addition to our hypothesis that advertising using the format of abrupt or looming motion may be processed preferentially to that of continuously moving or receding ones, we also expect that such differences will be further heightened when the content of advertising is relevant to the webpage. Thus, we hypothesize that there will be an interaction effect between content relevance and animated formats on ad recognition.

**H2a:** Content relevance moderates the effect of animated formats on ad recognition. Specifically, the difference in ad recognition between abrupt ads, continuous motion ads and static ads is greater when the content is relevant to the webpage than when it is irrelevant.

**H2b:** The difference in ad recognition between looming ads, receding motion and static ads is greater when the content is relevant to the webpage than when it is irrelevant.

### The Roles of Formats, Content Relevance and Shopping Tasks on Ad Recognition

Besides format and content, our understanding of the impact of animation on ad recognition should be enhanced by considering the user factors. The objective of service is to deliver the right content in the right format to the right person (Ho et al. 2005; Tam et al. 2006). To achieve this, an important factor that needs to be considered is users’ shopping tasks. Literature on e-commerce has identified two major types of shopping tasks: Searching and browsing (Janiszewski 1998; Hoffman et al. 1996; Li et al. 1999; Park et al. 2000). The former is goal-oriented, with an identified task, actively seek specific shopping targets; whereas the latter is less goal-oriented, browsing information with no clear goal in mind, and acting based on one’s own personal preferences (Hong et al. 2005).

Generally, it is assumed that a user’s attentional resources remain constant. There is a trade-off in attentional resource allocation between information relating to primary tasks and secondary tasks. A user may focus attention on the primary task (e.g., searching for a particular digital camera), and hence reduced the attentional resources available for processing the secondary task (e.g., recognize advertising). Therefore, we may expect that attentional resources available for processing advertising is scant during searching tasks, because users allocate most of their attentional resources to process information relevant to their primary tasks. For browsing tasks, however, there may be more attentional resources available for processing ad information, and users will allocate less attentional resources to primary tasks since they have no clear goal in mind during browsing. This rationale is consistent with
the findings of the study by Pagendarm et al. (2001) that ads were more memorable to browsers than to searchers. They proposed that “banner blindness” may occur, especially in a goal-directed searching task where information seekers tend to ignore animation, and consequently they may not remember the information from ads. In a similar vein, it may be expected that the term of “banner blindness” may occur during searching tasks. Based on the above rationales, though, we hypothesize in H2 that there is a significant interaction effect between animated formats and content relevance on ad recognition, we further expect that this moderating effect will be observed in users’ browsing tasks, but not in the searching tasks. Therefore, we hypothesize the following:

**H3:** There will be a three-way interaction between formats, content relevance and shopping tasks on ad recognition. Specifically, content relevance’s moderation of the effect of animated formats on recognition will vary with different shopping tasks. Combining animated formats with content relevance will lead to higher ad recognition in users’ browsing tasks than in searching tasks.

### Methodology

#### Experimental Design and Subjects

To test our hypotheses, a laboratory experiment was conducted in which a 5 (formats) ×2 (content relevance) ×2 (shopping tasks) between-subjects design was employed. The ad formats were comprised of five types: abrupt, continuous, looming, receding and static. There were two levels of manipulation of content relevance: A web page with relevant or irrelevant ads. Shopping tasks also included two levels: Searching and browsing task. A total of 292 subjects were recruited from universities in Hong Kong. The subjects were randomly assigned to experimental conditions. Each subject was paid HK$ 50 (about US$ 6.50) for their participation.

#### Experimental Website Design

An online shopping website that sells digital products was developed specifically for this research. Programming was done by using JAVA and ASP. Three categories of digital products were available on the website: MP3 players, digital mobiles, and digital cameras. During the pre-test phase, nine relevant ads (digital product banners) and nine irrelevant ads (snack food banners) were selected. The reason for selecting nine banners is that subjects will take part in nine shopping trips during the experiment. To avoid ad repetition, a new banner was displayed during each of the shopping trips.

Marketing literature suggests that familiarity, brand name, price and presentation order of products might influence consumers’ online shopping behavior. To avoid these biases, a series of preliminary tests were conducted. First, familiarity test was conducted to ensure that the products and ads used on the website have a similar level of familiarity. We used inter-rater reliability method to evaluate the familiarity of these materials. Two raters were asked to fill in a familiarity survey for each of digital products and ads. According to psychometrics literature, inter-rater reliability is the extent to which two or more raters agree (Landis et al. 1977; Shrout et al. 1979). If the score is more than .07, it indicates that the degree of agreement between the two raters is high. In this study, only brand names with medium level of familiarity were used on the experimental website. To eliminate the price effect of the products, we set three levels of price (high, medium, and low) for each of the product categories so as to differentiate users’ needs. Price was controlled at ±5% within each level of price (Hong et al. 2005; 2007). In addition, to reduce any confusion, the attributes of digital products and ads, such as brand name, image, logo, font size and color were kept constant on the experimental website. Finally, Latin square design was employed to balance the presentation order effect among the banners and products on the webpage.

#### Experimental Procedure

Subjects were assigned to either a searching or a browsing task through random selection by computer program. Half of the subjects were assigned to a searching task, and the other half were assigned to a browsing task. During the experiment, subjects were told to read the experimental instructions carefully and input their demographical information. The experiment administrator instructed the subjects to imagine themselves in an online shopping scenario. They entered nine online shopping trips: the first three are practices to ensure that the subjects become familiar with their tasks and the next six trips were experimental shopping tasks. Previous studies have suggested
that six trips are suitable to observe subjects’ shopping behavior (Hong et al. 2005). Generally, it took 10 minutes for the subjects to complete the shopping tasks. After that, they were assigned to a 3-minute distraction activity in order to clear their working memory. After the break, they were asked to participate in recognition tests and fill in questionnaires. The subjects were debriefed after all the tasks had been finished.

**Independent Variables**

*Animated formats* During the pre test phase, nine relevant ads (digital product banners) and nine irrelevant ads (snack banners) were selected. Based on the design of animation in this study, we focus on four kinds of animated formats: Abrupt, continuous, looming, receding and a static version to serve as control for baseline comparison. Each of the 18 banner ads was developed using these five different animated formats. The software Macromedia Flash (version 8) was used to design and construct the banners. A total of 90 ads (i.e., 18 banners x 5 types) were used in the experimental conditions. During the pre test, four raters were asked to evaluate the effectiveness of manipulation of animated formats based on the operational definitions (see theoretical part).

*Content relevance* was manipulated in the website by providing relevant or irrelevant ad banners on the webpage (see Figure 2). For example, in the relevant conditions, the subjects were exposed to the conditions where the content of ads was relevant to the content of the shopping website. Manipulation check of relevance was measured by five items (see Appendix).

*Shopping tasks* were manipulated by providing different instructions at the beginning of experiment. The subjects were asked to imagine themselves in a real online shopping scenario and to try their best to play their roles successfully. The instructions of the searching task were as follows: “Imagine that you want to buy six specific digital products as festival gifts for your family members. You have a shopping list with the six target products, which includes two digital cameras, two mp3 players and two mobile phones. You choose to shop online for saving time and for convenience. Visit www.isonliner (experimental website), which is an online shop selling digital products. During the experiment, you will take part in six ‘shopping trips’, and you are asked to buy one target digital product in each shopping trip. Each shopping trip contains five digital products (different brands) and one ad on the top of the webpage. The name of the products that you need to buy is shown on the top of the webpage. Your task is to search for this particular product and click the "Buy it now" button. Image yourself as a “timesaver”, who wants to use online shopping to save time and therefore complete the shopping process as quickly as possible.” For the browsing tasks, the subjects’ task is different. They were allowed to choose freely any brand from six products, and told to make decision based on their own personal preferences. Manipulation check of shopping tasks was measured by three items adopted from previous study (Tam et al. 2006).

**Dependent Variable**

*Ad recognition* A high level of ad recognition is desirable for online merchants, because it is an effective indictor of successful ad delivery. In the recognition test, 12 banners were displayed, including six ads that had appeared during the shopping trips and another six that had not. Subjects were told to identify the specific ads that they had seen in previous shopping trips. There are some limitations of using ad recognition. In a recognition task, a person is given a copy of the information that he or she needs to find in his/her memory (Taschian et al. 1988). This may lead to increased response bias, because it is known that respondents have the tendency to guess by providing “Yes” responses. In this study, we introduced the procedures advocated by signal detection theory (SDT) to counter for this response bias.

*Signal detection theory* Signal detection theory (SDT) is a method to quantify the ability to discern between signal and noise. It is used to understand some of human behavior when recognizing very faint and weak signals among other noises. In psychology literature, SDT for measuring recognition is well established (DeCarlo 2002; Green et al. 1966; Yonelinas 1994). Taschian et al. (1988) first claimed that it is necessary to introduce SDT as a method of improving ad recognition in the marketing and consumer research. It yields a consistent and reliable estimate of the user’s memory for a target ad (memory sensitivity). Similar to a typical SDT paradigm, a website is a mix of signal (ads)
and noise (background) in the e-commerce environment. Ad may be regarded as a signal which is expected to be detected by users from practitioners’ view. It is presented among many noise, such as words, pictures and news within the confines of the user interface. Therefore, the ability for users to detect ads (signal) accurately will be our focus in this study. In the recognition test, ad (signals) represent items that user have been exposed to before and noise consists of new ads that users have never been exposed to before. When subjects respond to a signal (ads) as a “signal” it is called a “hit”. When subjects response to noise (new ads) as a “signal”, it is called a “false alarm”.

The most commonly used SDT measure of sensitivity is $d'$ (called d prime), which is the standardized difference between the means of the signal present and signal absent distributions. $d'$ is an estimate of the strength of the signal (ads). To calculate $d'$, we need to know a respondent’s hit and false alarm rates. The formula for $d'$ is as follows: $d' = z(FA) - z(H)$, where FA and H represent false alarm and hit rates, respectively, that correspond to right-tail probabilities on the normal distribution. $Z(FA)$ and $z(H)$ are the z scores that correspond to the right-tail p-values represented by FA and H (Taschian et al. 1988; Ye et al. 2004).

Control Variables

Multiple methods were used to control the confounding variables and to improve the internal validity of the experiment. First, demographic factors such as age, gender, and education levels were controlled by randomly assigning the subjects to different experimental conditions. In addition, variables including individual PC experience, online shopping experience, familiarity with products and cognitive style were measured by items in the questionnaire and these variables were also controlled in data analysis.

Data Analysis and Results

Subjective Demographics

A total 292 of subjects were recruited from different academic departments. Among these subjects, 183 (62%) were females and 109 (37%) were males. All have experience in using the Internet: more than 80% had at least 6 years of Internet experience, over 70% used the Internet for at least 20 hours pre week, and about 73 percent of the subjects had previously online shopping experience.

Control and Manipulation Checks

No significant difference of subjects’ experience with PCs, the Internet and online shopping were found in all experimental treatments. It is indicated that control on subjects’ characteristics and past experience through
randomization appeared to be successful. Checks on the manipulations of content relevance and shopping tasks are performed. Manipulation checks on animated formats and ad familiarity (digital products and snack food) have been conducted on the pre test phase. The Cronbach’s alpha is .905 for content relevance and .792 for shopping tasks. For content relevance, subjects in the searching and browsing task treatments were asked to evaluate the relevance of ads message with on a seven-point Likert scale (see Appendix). Results of T-test showed that the average score of the digital ads (3.7) was more relevant to the content of the webpage than that of the snack ads (2.0), t (290) = 12.28 p < .000, indicating that the manipulation of content relevance is successful. To check the manipulation of shopping tasks, subjects were asked to evaluate if they had specific goals during the experiment with a seven-point Likert scale (see Appendix). Subjects in the searching task reported the higher levels of goal specification (5.5) than that of browsing task (5.1), t (290) = 2.55, p < .05, suggesting that the manipulation of shopping task is successful.

Hypotheses Testing

The means and standard deviations of the experiment treatments on dependent variable (d') were presented in Table 1. The results of ANOVA on ad recognition suggests that ad presentation formats significantly affect ad recognition [F (4, 287) = 4.42, p < .05]. Post hoc analysis based on LSD reveals that: 1) both motion continuity and changing size are associated with significantly higher ad recognition than the static ad format conditions, thus, supporting H1; 2) that abrupt format condition is associated with higher ads recognition (1.2) than the continuous format condition (0.8), t (106) = 1.86, p = .072, thus provided weak support for H1a; 3) and that ad recognition in looming format (1.0) is higher than those in receding format condition (0.62), t (128) = 1.89, p < .05, thus supporting H1b.

Table 1. Descriptive Statistics (Means and Standard Deviations)

<table>
<thead>
<tr>
<th>Formats</th>
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<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Relevant</td>
<td>Irrelevant</td>
<td>Relevant</td>
<td>Irrelevant</td>
<td>Relevant</td>
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<tr>
<td>Abrupt</td>
<td>2.36 (0.34)</td>
<td>0.40 (0.38)</td>
<td>1.26 (0.34)</td>
<td>0.77 (0.34)</td>
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<tr>
<td>Continuous</td>
<td>1.17 (0.30)</td>
<td>0.82 (0.34)</td>
<td>0.50 (0.32)</td>
<td>0.71 (0.30)</td>
<td></td>
</tr>
<tr>
<td>Looming</td>
<td>1.09 (0.32)</td>
<td>1.53 (0.31)</td>
<td>1.14 (0.34)</td>
<td>0.59 (0.28)</td>
<td></td>
</tr>
<tr>
<td>Receding</td>
<td>0.93 (0.25)</td>
<td>0.52 (0.32)</td>
<td>0.67 (0.35)</td>
<td>0.38 (0.27)</td>
<td></td>
</tr>
<tr>
<td>Static</td>
<td>-0.18 (0.31)</td>
<td>1.02 (0.41)</td>
<td>0.73 (0.37)</td>
<td>0.14 (0.28)</td>
<td></td>
</tr>
</tbody>
</table>

d’ value is shown in table1. N=292. *p<.05; ** p<.01; *** p<.001

Table 2. ANOVA Results on Ad Recognition

<table>
<thead>
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<th>F</th>
<th>Sig.</th>
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<td>Shopping Tasks</td>
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<td>.058</td>
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<tr>
<td>Formats × Content Relevance</td>
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<td>.026</td>
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<tr>
<td>Formats × Shopping Tasks</td>
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<td>.668</td>
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<tr>
<td>Formats × Content Relevance × Shopping Tasks</td>
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<td>3.56</td>
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</tbody>
</table>

Table 2 provides ANOVA results of the role of formats, content relevance and shopping tasks on ad recognition. The significant interaction effect indicates that the effects of ad formats are moderated by content relevance [F (4, 282) = 2.80, P < .05]. Under the relevant conditions, there is a significant effect of ad formats on ad recognition [F (4, 139) = 4.82, P < .001]. Further post hoc test suggests that recognition score in the abrupt format (1.80) is significantly higher than that of other types of formats, including continuous (0.85), looming (1.11), receding (0.83) and static (0.20). Therefore, H2 was partially supported.
To further understand the moderating role of content relevance on the relationship between formats and on ad recognition, formats were separated into two dimensions: motion continuity and changing size. There is a significant interaction between motion continuity and content relevance [F (2, 286) = 3.91, P < .05]. Under the conditions of content relevant, there is a main effect of motion continuity [F (2, 141) = 6.30, P < .05], suggesting that abrupt format (1.8) leads to higher ad recognition than that of continuous formats (0.85), t (54) = 2.59, P < .05. The standout effect of abrupt ad format is magnified under the content relevance conditions. Therefore, H2a was supported. In addition, the insignificant interaction between changing size and content relevant reveals that the effect of changing size (looming and receding formats) did not depend on content relevant [F (2, 286) = 0.26, P = .76]. Thus, H2b was rejected.

As expected, ANOVA on ad recognition yields a three-way interaction among formats, content relevance and shopping tasks [F (4, 272) = 5.26, P < .05], supporting H3. It is indicated that the interaction between formats and content relevance varies across online users’ different shopping tasks. It is investigated in more detail. Online users, who are less goal-oriented without indentified shopping goals (browsing tasks), show the significant interaction effect between content relevance and formats on recognition [F (4, 142) = 4.37, P < .05], but not for users who are under the conditions of searching (P = .64). It is suggested that the combining effect of formats and content relevance on ad recognition exerts effect in the searching tasks (see Figure 3 and Figure 4). To further understand the interaction effect of browsing task, we conducted simple main effect of formats. The significant effect of formats indicates that five types of formats (e.g., abrupt, continuous, receding looming and static) have different impact on web surfers’ recognition under the conditions of content relevance [F (4, 76) = 5.35, P < .001]. The multiple comparisons (LSD) suggest that both abrupt and looming ad format leads to higher recognition than that of static format (see Table 3). A summary of the hypothesis testing results is presented in Table 4.

<table>
<thead>
<tr>
<th>(I) Formats</th>
<th>(J) Formats</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Abrupt</td>
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<td>.49</td>
<td>.39</td>
<td>.21</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>.18</td>
<td>.39</td>
<td>.63</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>.73</td>
<td>.37</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1.23*</td>
<td>.41</td>
<td>.00</td>
</tr>
<tr>
<td>2. Motion</td>
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<td>-.49</td>
<td>.39</td>
<td>.21</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-.30</td>
<td>.37</td>
<td>.40</td>
</tr>
<tr>
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<td>4</td>
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<td>.49</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>.73</td>
<td>.39</td>
<td>.06</td>
</tr>
<tr>
<td>3. Looming</td>
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<td>-.18</td>
<td>.39</td>
<td>.63</td>
</tr>
<tr>
<td></td>
<td>2</td>
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<td>.37</td>
<td>.40</td>
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<td>4</td>
<td>.54</td>
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<td>5</td>
<td>1.04*</td>
<td>.39</td>
<td>.00</td>
</tr>
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<td>4. Receding</td>
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<td>-.73</td>
<td>.37</td>
<td>.05</td>
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<tr>
<td></td>
<td>2</td>
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<tr>
<td></td>
<td>5</td>
<td>.49</td>
<td>.37</td>
<td>.18</td>
</tr>
<tr>
<td>5. Static</td>
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<td>-1.23*</td>
<td>.41</td>
<td>.00</td>
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</table>
Figure 3. The Interaction between Formats and Content Relevance under Browsing and Searching Tasks

Figure 4. The Interaction between Formats and Relevance under Browsing Task

Table 4. Hypotheses Testing Results

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1 Animated &gt; Static</td>
<td>Supported</td>
</tr>
<tr>
<td>H1a Abrupt &gt; Continuous</td>
<td>Partially Supported</td>
</tr>
<tr>
<td>H1b Looming &gt; Receding</td>
<td>Supported</td>
</tr>
<tr>
<td>H2 Formats × Relevance</td>
<td>Partially Supported</td>
</tr>
<tr>
<td>H2a Motion Continuity × Relevance</td>
<td>Supported</td>
</tr>
<tr>
<td>H2b Changing Size × Relevance</td>
<td>Rejected</td>
</tr>
<tr>
<td>H3 Formats × Relevance × Shopping Task</td>
<td>Supported</td>
</tr>
</tbody>
</table>
Discussion and Implications

Key Findings

The current research has investigated the effects of animated ads on ad recognition, as well as contingent factors including content relevance and shopping tasks. Major findings are summarized in Table 4 and are discussed below. Firstly, we conceptualize and differentiate four types of animated formats into two dimensions: Motion continuity (abrupt vs. continuous) and changing size (looming vs. receding). It is found that these animated formats function differently in terms of users’ ad recognition. The results not only confirm the existing literature that animation leads to higher users’ cognitive performance than static ones (Diao et al. 2004; Hong et al. 2007; Li et al. 1999), but also extend our understanding of animation effects by showing that: (1) Advertising in abrupt formats leads to higher ad recognition than that in continuous formats; and (2) advertising in looming formats leads to higher ad recognition than that in receding formats.

Secondly, content relevance moderates the animation effect on ad recognition, suggesting that the effect of the format on users’ ad recognition depends on whether the ad content is relevant to that of the webpage. Interestingly, a fairly robust combination effect between content relevance and the abrupt format has been observed in this study.

Thirdly, content relevance’s moderating effect on the relationship between the formats and ad recognition varies with different shopping tasks. The robust interaction between the abrupt format and content relevance is confined to browsing tasks, rather than searching tasks. When users who are engaged in browsing tasks have no clear shopping goals in mind, they may allocate more attentional resource to animated ads on the webpage in the relevant conditions.

Theoretical Contributions

Implication for the design of animated formats

To the best of our knowledge, this is the first study that has systematically conceptualized animation, based on theories from cognitive psychology and communication literature (Duncan 1984; Kahneman et al. 1992; Lee 1976; Lee et al., 2003; Reeve et al. 1996; Wang et al. 1992). Although previous IS literature helps us understand the effects of animation, it has generally been defined animation as any kind of motion on the Web (Hong et al. 2004; Zhang 2000; Zhang 2003). Therefore, this study may bridge the research gap, extending the conceptualization of animation by using four distinct formats.

This study has applied theories and findings from cognitive psychology to understand the effects of animation. According to object-based theory, when a new object (animation) abruptly appears in one’s vision, a corresponding object is created, which in turn leads to allocation of attention to this new animation (Duncan 1984; Kahneman et al. 1992). Abrams and Christ (2003) have found that a user’s attention is drawn to the object (animation) that suddenly begins to move abruptly, but not to an already moving or continuously moving object. The result of H1a is consistent with the visual literature, by showing that an animated ad (an object) in an abrupt format leads to higher recognition than one in continuous motion. Similarly, the result of H1b is consistent with the literature on urgent behavior theory, in which looming objects (advertising) generate more cognitive benefits than receding ones, because looming is a significant cue for human beings, and may convey more important characteristics of priority in an environment (Lee 1976; Wang et al. 1992). Therefore, the results confirm the appropriateness of applying these theories from cognitive psychology to the e-commerce domain.

Implications for animation and web personalization

The findings imply that the positive effect of abrupt animation is magnified under the conditions of content relevance. Theoretically, it extends our understanding of the existing paradoxical view of animation. Despite animation being a powerful visual presentation format on the Web, it is also regarded as being disruptive and annoying, e.g., being interrupted by the abrupt appearance of animation is a typically negative experience for many users. To better understand the impact of animation, the identification of contingency factors is necessary. Previous IS researchers have examined contingency factors that affect animation (Hong et al. 2004; Zhang 2000). This study extends the contingency models of animation by including content relevance. The results show that combining content relevance and abrupt formats is an effective advertising delivery strategy, in the context of personalized...
services on the Web. This study integrates animation literature with web personalization perspectives (Tam et al. 2005; 2006).

The findings are consistent with cognitive psychology literature that whether or not an object (advertising) has an impact on information search performance depends on both the relevance factor and salient effect of the object itself (Theeuwes 1990). Salient objects are more likely to attract attention when they are relevant or perceived to be relevant to the processing task (Yantis et al. 1999). Again, the results indicate the appropriateness of applying theories from cognitive psychology to the e-commerce domain. In addition, the effects of animation can disappear under conditions of irrelevance, which is consistent with Zhang’s (2000) results showing that irrelevant animation reduced search performance. When the attention of users was disrupted by abruptly displayed irrelevant advertising, they spent considerable attentional resources coping with such interference, which in turn reduced recognition performance. Although animated advertising is not a panacea on the Web, the findings support that the combination of formats with content may be an effective strategy to improve ad recognition in the e-commerce environment.

Implications for triadic relationship among formats, content and shopping tasks

Besides content relevance, our understanding of the impact of animated formats on recognition is enhanced by adding in the users’ shopping tasks to the contingent model. One of the streams of HCI research is the development of user-centered systems. This study highlights the importance of taking into account the shopping tasks in understanding the relationship between HCI technologies and the behavior of online users. As Tam and Ho (2006) noted, the ultimate goal of a personalized service is to deliver the right content with the right formats to the right users. This study integrates the triadic relationship among animated formats, content relevance and user modes.

This finding is an important extension to the existing IS literature (Tam et al. 2006), which indicates that shopping tasks moderate the effect of content relevance on users’ recall performance. This study suggests that this two-way interaction model depends on the different presentation formats. In addition, our findings also suggest that the effect of animation and relevance is constrained for browsing tasks, but not for searching tasks. This seems to be consistent with Pagendarm’s argument (2001) that the term “banner blindness” occurs particularly in goal-oriented search tasks, where users may ignore animated advertising, and consequently ads are more memorable to web surfers than goal-driven information seekers.

Implications for an effective indicator of advertising

From a methodological perspective, this study makes a significant contribution by introducing signal detection theory (STD) to improve ad recognition in the e-commerce environment. Indicators for indentifying the effectiveness of advertising have been an important issue for both practitioners and academics (Drèze et al. 2003). There are many advantages of using SDT, since it is a more valid measurement than percentage measures, and it can evaluate both the actual sensitivity and the potential response bias (Green et al. 1966; Yonelinas 1994). From the marketing literature we learn that Taschian et al. (1988) first claimed that it was necessary to introduce SDT as a method for improving ad recognition. To the best of our knowledge, there was no empirical study using SDT until 2004, when Ye and Van (2004) employed it to test the components of brand awareness in traditional media settings. Therefore, this study fills the research gap by using the signal detection method to measure ad recognition.

Practical Contributions

First, the current study provides practical implications for both online retailers and web designers. The systematic evaluation of animation suggests that not all types of presentation formats exert an equal impact in the e-commerce environment. The conclusion favors the adoption of abrupt and looming formats as the most effective IT artifacts in improving ad recognition. Second, current results may benefit designers by showing that the combining effect of abrupt animations and content relevance is robust. It can provide online practitioners with effective advertising strategies, regarding how to deploy appropriate animated formats so as to fit content relevance successfully. The effect of animated advertising rarely occurs in isolation in the complex web environment, since it depends on other factors, such as content relevance. Although most website designers are probably aware that the abrupt format can often be annoying, and that users dislike it, the results of this study imply that the way to deliver this kind of format depends on the content relevance. If web designers combine the abrupt format with relevant content, its effectiveness is robust and salient. Third, the findings of this study can provide guidance on how to choose between the different format types and content so as to fit particular shopping tasks. For example, when consumers have less specific goals (browsing tasks), web designers can use the abrupt format along with content relevant. To maximize
business opportunities, online merchants should adopt a more adaptive strategy that is sensitive to the processing goals of users.

Limitations and Future Study

It is necessary to consider some of the limitations in order to better explain the results of this study. First, the subjects in the study were Hong Kong college students. The use of student subjects is often criticized for lack of generalizability. Second, although a laboratory experiment may help to improve internal validity by eliminating confounding factors, it may also limit the generalizability of our conclusion. Hence, future studies may conduct a field study where online shopping behaviors in the real e-commerce context are tested. Thirdly, online products used on the experimental website belonged to two categories: digital products and snack foods. However, other product categories might generate different results for users. For example, for products such as jewelry or cosmetics, users may process advertising differently. Finally, although ad recognition is an indicator of the effectiveness of advertising, other indicator, such as attitude is also an important consideration. It has demonstrated that abrupt animation is effective in capturing attention, but if users consider it annoying, their attitude toward the ads and the brand may be negatively affected.

Conclusion

In conclusion, using a trivariate model this study examines the roles of ad formats, content relevance and shopping tasks on ad recognition. By focusing on these three contingent variables, this study develops a more comprehensive and integrated model for the understanding of animation delivery strategies in the e-commerce environment. The findings suggest that both abrupt and looming formats are effective advertising formats in improving ad recognition. In addition, the robust combining effect of ad formats and content relevance was observed, i.e., abrupt advertising leads to higher ad recognition under the conditions of content relevance. This combining effect is confined to users engaged in browsing tasks, but not to those engaged in searching tasks. It is suggested that the effect on ad recognition of the content relevance’s moderation of animation format varies with the different shopping tasks.

Acknowledgements

The work described in this paper was supported by City University of Hong Kong Strategic Research Grant (Project No. 7002344).

References


**Appendix**

**Measurement Items**

**Content Relevance**

1. I found that the banner ads appearing on the Web page were relevant to my tasks.
2. I could get some indications from the banner ads when doing the shopping task.
3. I found that the information of banner ads and products were related.
4. I found that the banner ads on the Webpage were relevant to my interest.
5. Banner ads on the Webpage were consistent with my target product.

**Shopping Tasks**

1. I had ideas on what product I should look for.
2. I knew what my target product was.
3. I knew what information I should access.