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ABSTRACT

A lot of studies in the information systems, advertising, and marketing literature have shown that for the past two decades online banner ad click-through rate is decreasing steadily (Idemudia et al. 2007). To address this issue, we develop the Visual Perception Model (VP) for Online Target marketing and then conducted an experiment by manipulating the independent variables (i.e. perceived security of online banner ads and match between web user's need and banner ad contents). The theoretical background for the VP Model is the Visual Perception Theories. The VP Model shows that perceived usefulness of online banner ads have a positive and significant effect on the intention to click online banner ads. Also, the VP Model shows that both perceived security of online banner ads and match between web user's need and banner ad contents has a positive and significant effects on perceived usefulness of online banner ads. The result provides support for the visual perception theories.

Keywords (Required)

Visual perception theories, visual perception model, online ads, click-through rates, Internet advertising

INTRODUCTION

The study of the visual perception of banner ads is very important because this helps explain why the click-through rates of online banner ads have been decreasing continuously for the past two decades. Our study also provides important insights to online firms and banner ads designers on how to evaluate and design effective online ads. Online banner ads are stationary or moving images/graphics that are displayed on the monitor to advertise products and services (Idemudia, Jin, and Lin 2007; Li et al. 2007). The design of target online banner ads consists of three components: (1) input (the data is collected from cookies, web logs, or the log files for an ecommerce web site); (2) process (mathematical modeling such as linear programming or pricing model that generate the banner ads); and (3) output (where banner ads are displayed to users) (Idemudia et al. 2007; Idemudia 2009, 2010; Li et al. 2009). In the information systems and computer science disciplines, there has been a lot of research on the process component that involves the development of algorithms, techniques, programs, codes, and mathematical models to accurately display the right target online banner ads to web users and online visitors (Amiri and Menon 2001; Attardi, Esuli, and Simi, 2004; Feng, Bhargava, and Pennock 2006; Hoffman, Novak, and Chatterjee 1997; Idemudia 2009, 2010; Lacerda, Cristo, Goncalves, Fan, Ziviani, and Ribeiro-Neto 2006; Langheinrich, Nakamura, Abe, Kamba, Koseki 1999). There has not been much research that addresses the output design components such as the visual perception of online ads that influences the intention to click online banner ads (Idemudia 2010). Hence, the limited research on factors that influence the output components of online banner ads might have led to the constant decline in online ads click-through rates.

The study of how people gain information through our sensors about things, people, and events in the world is known as perception (DeLucia 2007; Gordon 2004). Perception is one of the oldest fields in psychology; as a result there are many theories in visual perception. The study of the visual perception of online banner ads is important to maintain the growth of Internet revenue, sales and click-through rates. For example, on April 13, 2011, The Internet Advertising Bureau (IAB) announced that the Internet advertising revenue for 2010 in the US was $26 billion, up 15% from 2009 (IAB 2011). Also, in the year 2010, all the four quarters reported were record level revenues compared to previous years' quarters (IAB 2011).

One of the most common pricing models that are used to measure the effectiveness, helpfulness, success, and value of online banner ads is the click-through rate (Idemudia et al. 2010; Li et al. 2009). The click-through rate is the percentage of web users or online visitors that are exposed to online banner ads and then click the online banner ads (Idemudia et al. 2007; Li et al. 2009). For the past decade, the banner click-through rate has been decreasing continuously (Idemudia et al. 2007; Li et al. 2009). Animation, computer graphics, and moving graphics of online banner ads have not improved click-through rates (Yoo and Kim 2005). To address the issue why banner click-through rate is decreasing continuously, we develop the Visual Perception (VP) model. The theoretical background for the VP model is the visual perception theories. The VP Model for Online Target Marketing helps explain why banner click-through rates have been decreasing and what factors influence the perceptions of online banner ads.

The rest of this paper is organized as follows: the next section presents the Visual Perception Theories; Section 3 presents the research model and the development of hypotheses. Section 4 describes the research method. Section 5 discusses the data analysis and reports the result, and section 6 discusses the conclusion, limitation of the study, and potential direction for future research.

THEORY

Visual Perception Theories

The theoretical backgrounds for the Visual Perception (VP) Model are the visual perception theories. It should be noted that the most common paradigm in visual perception research is empiricism (DeLucia 2007). In his classic book, Gordon (2004) state, "The idea that perception is something more than the direct registration of sensations; that somehow other events intervene between stimulation and experience" (pg 119) supports that visual perception is a learned process. Gordon (2004) works explain that visual perception involves cognition and mental processing. As shown in *Figure 1*, DeLucia (2007) argues that visual perception is a mediated process that involves the disambiguating of the sensory data through cognitive processes.
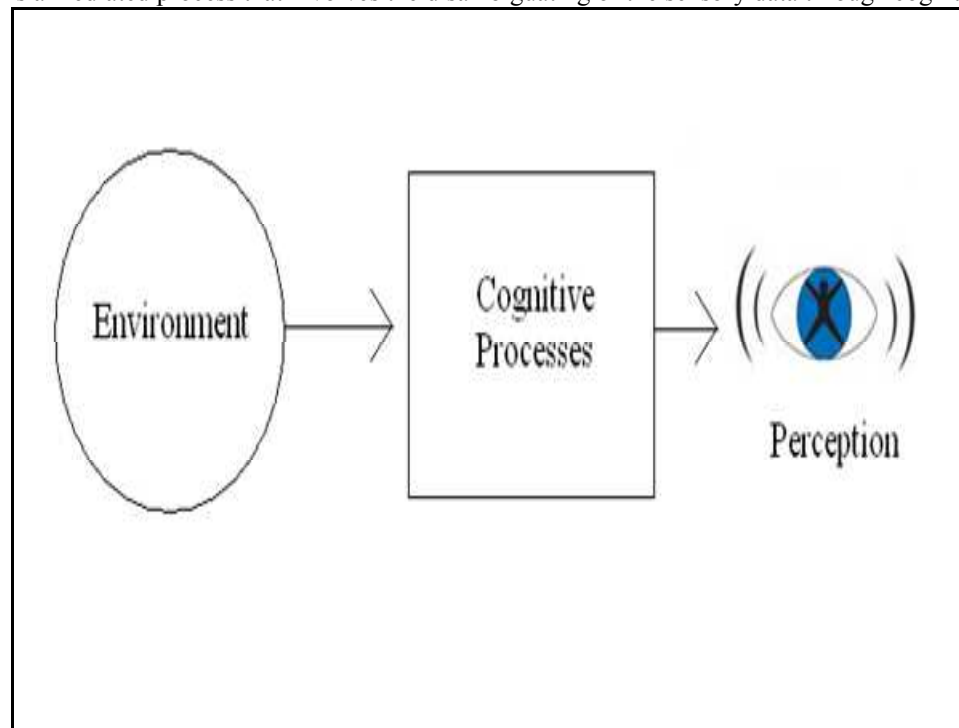

Figure 1: Visual Perception Theories (Source: DeLucia, 2007)

Gordon (2004) argues that ambiguous stimuli and context influence visions. Visual perceptions involve experience, familiarity, knowledge, and past experience (Locke 1877). Children know the differences between sweet and better before they can articulate what those differences are through exposure, experience, and familiarity (Locke 1877). Familiarity and association influence visual perceptions of the external environments (DeLucia 2007; Gordon 2004; Kulpe 1904; Porter 1954). Kulpe (1904) confirms his hypothesis that visual perceptions involve familiarity by using his tachistoscope to display various letters with different colors, shapes, images, graphics, and sizes, and then asked observers to describe what they saw. Initially, when the observers were asked what is the color of the letters and shapes? They all gave inaccurate answers. Porter (1954) demonstrates the concepts that hints play a major part in visual perception; and that visual perception involves familiarity, cognitive, association, and mental processing.

One of the founders of visual perception research, Helmholtz (1857) argues that visual perception is and indirect, learned, and inferential process. Visual perception is not simple an input process (Kulpe 1904; Sanford 1936). Bartlett in his classic book titled Remembering (1932) presents that prior expectations, experience, and long-term remembering influence visual perceptions. Visual perception is a constructive process that involves familiarity, cognitive, and mental processing (DeLucia 2007; Helmholtz 1857; Kulpe 1904; Sanford 1936). Berkeley (1709) demonstrates that distance and vision are perceived through experience, exposure, and familiarity. To further support Berkeley's argument, Allen and Rashotte (2006) conducted an experiment, and the finding is that the accuracy of distance estimation is learned and improved from constant feedback. Distance and visual perceptions are learned (Allen and Rashotte 2006; Berkeley 1709).

RESEARCH MODEL

Our research model, the Visual Perception (VP) model draws its theoretical foundation from the visual perception theories, that perception involves cognitive and mental process as shown in *Figure 1*. To be consistent with prior visual perception researchers (DeLucia 2007), our research model focuses on environment (i.e. banner ads that are displayed on the monitors), cognition, and intention/action (i.e. intention to click online banner ads). Our research model (environment/external factors➔ cognition➔behavioral intention to click banner ads) is shown in *Figure 2*. In our model, the external factors are perceived security of online banner ads and match between web user's need and banner ad contents. Davis (1989) argues that perceived usefulness is a cognitive process. In the psychology discipline, some researchers have demonstrated that usefulness is a cognitive process (Norman 2002; Yamazaki, Yamaoka, Okada, Saitho, Nomura, Yanagida, 2006)
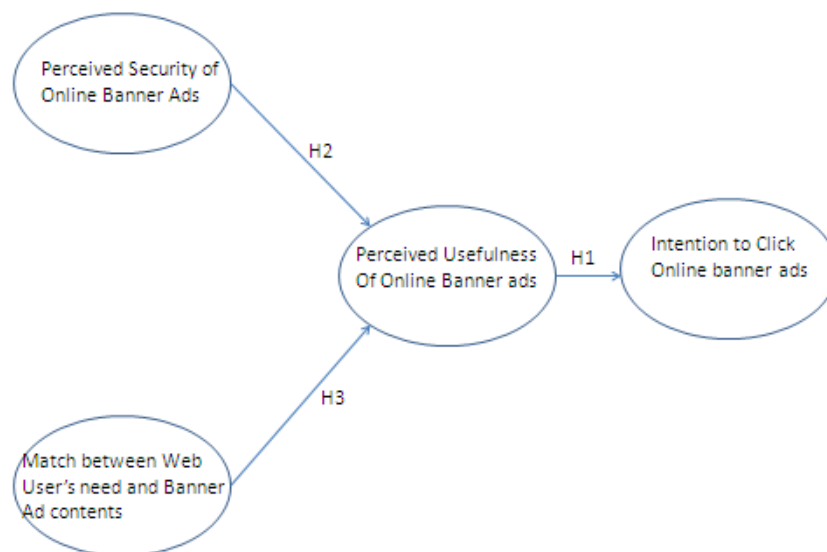

Figure 2. The Visual Perception Model for Online Target Marketing

The key constructs for our research model from right to left are intention, perceived usefulness, perceived security, and match between web user's need and banner ad content. To be consistent with prior study; *o*ur study focuses on intention to adopt online banner ads rather than the behavior of adoption, because in the IS discipline, the role of intention as a strong predictor of behavior is well established (Davis 1989; Davis, Bagozzi, and Warshaw 1989; Komiak and Benbasat 2006; and Venkatesh, Morris, Davis, and Davis 2003).

Perceived Usefulness of Online Banner Ad

Davis et al. (1989) define perceived usefulness as "the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" (p. 985). Vijayasarathy (2003) defines perceived usefulness in the context of online shopping "as the extent to which a consumer believes that on-line shopping will provide access to useful information, facilitate comparison shopping, and enable quicker shopping" (p. 750). Hence, Idemudia (2009) defines perceived usefulness of online banner ad as the degree to which a web user believes that using online banner ads would enhance his or her purchasing performance. A lot of researchers in the IS discipline and literature have shown that perceived usefulness is a cognitive and mental process that has a positive and significant effect on the behavior intention to use and adopt a wide range of IT/IS platforms and domains (Davis 1989; Davis, Bagozzi, and

Warshaw 1989; Komiak and Benbasat 2006; and Venkatesh, Morris, Davis, and Davis 2003). Some psychology studies have supported the importance of perceived usefulness (Norman 2002; Yamazaki, Yamaoka, Okada, Saitho, Nomura, Yanagida, 2006). Yamazaki et al. (2006) argue that designers should design products that are perceived to be useful (i.e. address users' immediate needs). In addition, Norman (2002) argues that designers should ensure that design products are useful. We summarize the preceding discussion with the following hypothesis:

> *Hypothesis 1: Perceived usefulness of banner ads will positively affect the intention to click online banner ads.*

Perceived Security of Online Banner Ads

Vijayasarathy (2004) defines security as "the extent to which a consumer believes that making payments on-line is secure" (p. 751). Hence, Idemudia (2009) defines perceived security of online banner ads as the degree to which web users or/and online visitors perceive that their sensitive and delicate information is protected and private, thus making them comfortable and relax when deciding to click online banner ads. The fear of lack of security is one of the most critical and significant factors identified by researchers in their studies that hinder the growth of ecommerce revenues, incomes, earnings, profits, market shares, and online sales (Vijayasarathy 2004; Warrington et al. 2000). Web users or/and online customers feel secure, safe, protect, content, and satisfied if their personal records and information are confidential and private (Hoffman and Novak 1998; Vijayasarathy 2004). Thus, perceived security of online banner ads are significant considerations that might affect perceived usefulness of online banner ads. We summarize the preceding discussion with the following hypothesis:

> *Hypothesis 2:Perceived security of online banner ads will positively affect the web users' perceived usefulness of banner ads.*

A match between banner ad content and users' needs

Consumer preference theory states that consumers' tastes and preferences vary across individuals (Green and Krieger 1989; Karuga et al. 2001). Thus, banner ad contents that match online visitors and web users' immediate needs and wants are perceived to be useful; thus, influencing web users decision making to click online ads (Idemudia et al. 2007; Li et al. 2010). This construct is similar to web banner ads personalization (Idemudia 2009;Idemudia 2009). Kazienko and Adamski (2007) define web banner personalization as "adaptation to individual preferences of users" (p. 2269). Thus, Idemudia (2009) defines the match between banner ad content and the user's immediate needs as the extent to which the banner ad displays the right banner ad content at the right time that addresses web users' immediate needs, wants, and preferences. Adam (2004) argues that for banner ads to be effective and efficient the right banner ad content and context should be displayed to web users or/and online visitors at the right time and location. Also, Yamazaki et al. (2006) argue in their universal design principles that, designers should make sure that the correct and appropriate information is displayed to all users at exactly the right time and location. We summarize the preceding discussion with the following hypothesis:

> *Hypothesis 3: A match between banner ad content and users' needs will positively affect the perceived usefulness of banner ads.*

RESEARCH METHOD

Participants and Data Collection Procedures

We collected data for our study from 124 students enrolled in a large public university located in the eastern part of the United States of America. The characteristic of participants in our study is shown in *Table 1*. To enhance external validity, we ensure that our participants were subjects who are familiar with online banner ads, banner ad links, and they shop regularly online. The main reason why we recruited college students as subject for our study is that in the near future, college students are the influential customers in the online environments/domains (Chang and Cheung 2001; Lin and Lu 2000); and college students shopped the most online and their online shopping activities are expected to increase drastically in the future (CSRE Campus Market Research Series, 2001). We controlled for common method bias by implementing the two main approaches proposed by Podsakoff et al. (2003). The two main approaches are procedure and statistics. The procedural approach consisted of the following steps: (1) we eliminated the measures that are common to all variables to prevent subjects from knowing the relationship between the dependent and independent variables; (2) the data for our study were collected four times in the classroom that have computers at different locations, times, and dates; and (3) we ensured that respondents' answers to the questionnaire were anonymous. The second approach proposed (i.e. statistical remedies for self-reported data) by Podsakoff et al. (2003) is discussed in detail in the data analysis and results. Following Podsakoff et al.'s (2003) recommendations, before administering the questionnaire to subjects, we conducted a pilot test with students to eliminate any ambiguity in the directions, instructions, and wording of measurement items in the questionnaire.

Have used the Internet to shop online (Yes, No)	Yes = 124 No = 0
Have clicked online banner ads (Yes, No)	Yes = 124

	No = 0
Hours Spent per week using the Internet	Mean = 18.07
Over the past 12 months, approximately how many times have you shopped using the Internet	Mean = 17.48
Age	Mean = 25.34
Gender	Female = 49 (40.16%) Male = 72 (59.02%) Unknown = 1 (0.82)
Graduate or Undergraduate	Undergraduate = 122 (100%)
Over the past 12 months, approximately how much have you spent on purchasing using the Internet	Less than $100 = 42 (34.43%) More than $100 = 79 (64.75%) Unknown = 1 (0.82)

Note: The sample size is 124.
Table 1. Participants' Characteristics

The hypotheses were tested in an experiment in which an online banner ad is display to each participant who shop online regularly and are familiar with online ads. A 2 X 2 factorial design was used. The treatments for our study were perceived security (low versus high) and perceived match of banner ad content (low versus high) *Table 2*.

		Perceived Match of Banner Ad Content	
		Low	High
Perceived Security	**Low**	Group 1 (30)	Group 2 (31)
	High	Group 3(31)	Group 4 (30)

Table 2. Experimental Design

Independent Variable: Match between Banner Ad Content and Users' Needs

The online banner ad shown in *Figure 3* represents banner ad with a higher match between banner ad content and users' needs than that shown in *Figure 4*. These two online banner ads were identical in many aspects—have the same shape, color, and almost similar contents. We expect the two online banner ads to differ in their match between banner ad content and users' needs. Web users and online customers who are looking to purchase products and services online at always lower prices are more likely to click the higher match between banner ad content and users' need because Wal-Mart has a well established reputation for selling products at a lower prices compared to Kenworth.

Figure 3. High-match between banner ad content and users' needs

Figure 4. Low-match between banner ad content and users' needs

Independent Variable: Perceived Security of Online Banner Ads
Two levels of perceived security were studied: low versus high. Two identical online banner ads were display—the two ads have the same color, content, and shape. The main difference between the two ads is that the high-perceived security of online ad has the word "McAfee" and the low-perceived security of online ad has the word "bitdefender". The assumption is that web users have the perception that McAfee have better antivirus software that are more secure and protected for computer usage compared to bitdefender.
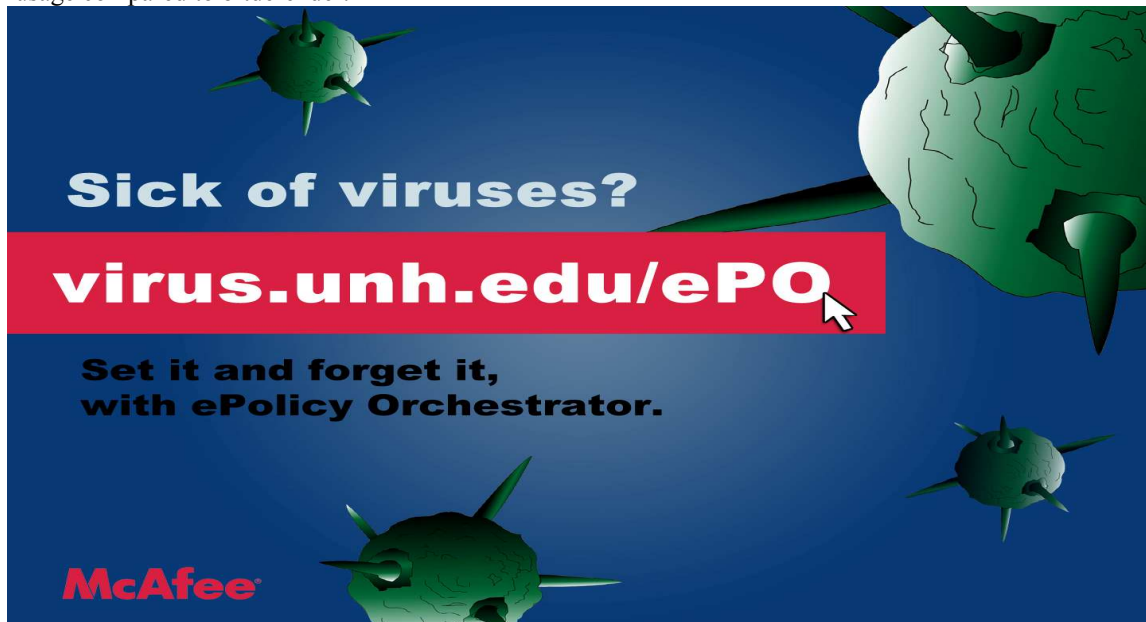

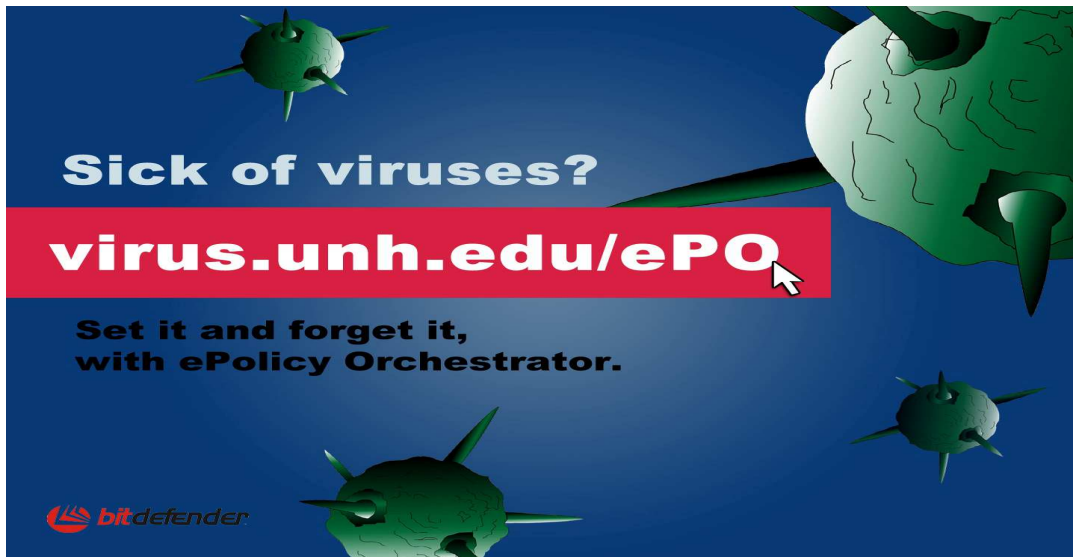**Figure 5. High-Perceived security of online banner ads**

Figure 6. Low-Perceived security of online banner ads

Experimental Procedures

Each participant took the experiment individually and the time spent by most participants to complete the questionnaire was between 20 and 30 minutes. The procedure for administering the questionnaires was as follows:

(1) Printed instructions were read aloud to all subjects by the instructor.

(2) Subjects were asked to read the survey questions very carefully and to answer all questions to the best of their ability.

(3) Participants read the information sheet relating to their perceptions of online banner ads. He or she then completed and signed a consent form and background questionnaires.

(4) Participants were each shown online banner ads on their monitor.

(5) Participants answered the manipulation check question about perceived security and perceived match of online banner ad contents.

(6) Participants completed the questionnaires relating perceived usefulness and intention to click online banner ads. It should be noted that the questionnaire was completed only once by each participant in our study.

(7) The instructors who moderated the completion of the questionnaire ensured that all subjects answered all questions.

The Operationalization of Constructs and Measurement Scales

Perceived usefulness of banner ads and intention to click banner ads were each measured using seven point Likert scaled items that were developed and validated by Davis (1989), Davis et al. (1989), and Venkatesh et al. (2003). A match between web users' immediate needs and banner ad content (i.e. personalization) was adapted from Idemudia 2009. The perceived security of banner ads was measured using the Vijayasarathy (2004) and Idemudia (2009) seven-item Likert scale.

DATA ANALYSIS

In our study, for the data analysis, we followed the two-step approach (measurement model and structural model) suggested and recommended by Anderson and Garbing (1988) to assess convergent validity, discriminant validity, model fit, and to test hypotheses. In the first step (measurement model), to show and assess constructs validity (i.e. convergent and discriminant validity), item reliability, and composite reliability we used confirmatory factor analysis (CFA). In the second step (structural model), using measurement variables that were retained from the measurement model, we fit our theoretical model (The Visual Perception Model for Online Target Market). In our study, we chose CFA in the first step (measurement model), because Bagozzi and Phillip (1982) argue that CFA is more appropriate for adopting prior theory research and pre-validated measurement scales compared to exploratory factor analysis. For our study, in the second step (structural model), we used CFA to test the hypotheses by examining the value and significance of each individual path in the VP Model for Online Target Market. We support this two-step data analysis approach compared to the one-step approach because the former provides a more complete and robust test for measuring convergent validity, divergent validity, composite reliability, hypotheses testing (Anderson and Garbing 1988).

Scale Validation and Measurement Model

In our study, we used CFA to assess construct validity, reliability, and variance extracted estimates. In our study, the validation of construct validity proceeds in two phases: (1) convergent validity and (2) discriminant validity. We implemented three conditions as reported in *Table 3*, to assess convergent validity. The three conditions we implemented to assess convergent validity are: (1) the CFA loadings in our study indicate that all measurement scale items are significant and exceed the minimum value criterion of 0.70; (2) the construct composite reliability for each construct exceeds 0.80; and (3) the construct average variance extracted estimate (AVE) for each construct exceeds 0.50. Hence, all conditions for convergent validity that are recommended by Fornell and Larcker (1981) are met in our study. The criterion we used to assess discriminant validity is the recommendation from Fornell and Larcker (1981) that states the square root of AVE for each construct should surpass the correlation of that construct and any other constructs. From *Table 5*, the highest correlation between a particular construct and any other construct is 0.7925; hence this value is lower compared to the lowest square root of average variance extracted estimate (AVE) of all the constructs, which is 0.8668.

Construct and Indicators	Loading	Indicator Reliability	Error Variance	Reliability	Variance Extracted Estimate (AVE)
Intention to Click Online Banner Ads (FA1)				0.9364^C	0.7865
I1	0.8918	0.7953	0.2047	0.7953	
I2	0.8826	0.7790	0.2210	0.7790	
I3	0.8577	0.7356	0.2644	0.7356	
I4	0.9143	0.8359	0.1641	0.8359	
Perceived Usefulness of Online Banner Ads (FA2)				0.9378^C	0.7514
U1	0.8574	0.7351	0.2649	0.7351	
U2	0.8826	0.7790	0.2210	0.7790	
U3	0.8984	0.8071	0.1929	0.8071	
U4	0.9037	0.8167	0.1833	0.8167	
U5	0.7867	0.6189	0.3811	0.6189	
Perceived Security of Online Banner Ads (FA3)				0.9486^C	0.8220
S1	0.8989	0.8080	0.1920	0.8080	
S2	0.9447	0.8925	0.1075	0.8925	
S3	0.9289	0.8629	0.1371	0.8629	
S4	0.8513	0.7247	0.2753	0.7247	
Match between Web User's Need and Banner Ad Content (FA4)				0.9191^C	0.7914
M1	0.8839	0.7813	0.2187	0.7813	
M2	0.9323	0.8692	0.1308	0.8692	
M3	0.8507	0.7237	0.2763	0.7237	

Note: ^{C} Denote composite reliability. All loading in Table.2 are significant at p<0.0001.

Table 3. Construct, Indicators, Reliability, Error Variance, & Variance Extracted

Construct	Composite Reliability	AVE
Intention to Click Online Banner Ads	0.9364	0.7865
Perceived Usefulness of Online Banner Ads	0.9378	0.7514
Perceived Security of Online Banner Ads	0.9486	0.8220
Match between Web User's Need and Banner Ad Content	0.9191	0.7914

Table 4: Construct Reliability and AVE

Construct	INT	PU	PS	MC
INT	*0.8868*	0.7629	0.6363	0.5668
PU		*0.8668*	0.7925	0.6321
PS			*0.9066*	0.5526
MC				*0.8896*

Note: The diagonal values represent the square root of the average variance extracted (AVE) of the specific construct. Construct legend: INT: Intention to Click Online Banner Ads; PU: Perceived Usefulness of Online Banner Ads; PS: Perceived Security of Online Banner Ads; MC: match between Web User's Need and Banner Ad Content.

Table 5. AVE and Correlations among Latent Constructs

Hypotheses Testing and Structural Model

The second step of data analysis is hypotheses testing to examine the value, significance, and strength of each path in our model. In our study, we used CFA analysis to examine the R-square score of each endogenous variable and the explanatory power and significance of each path in our model. For data analysis, we used structural equation modeling (SEM) because SEM can be used to analyze all paths in the model as one analysis (Chin 1998). The result for the data analysis as shown in *Figure 7* include path coefficient, path significant, and the constructs' variance explained by the R-square. In the structural model, the CFI is 0.9495, which is greater than the 0.90 benchmark recommended by Bentler (1992), thus supporting that the measurement model demonstrates a good fit of the data.
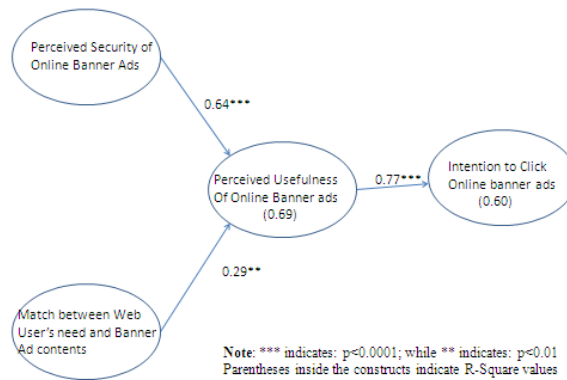

Figure 7. Results of SEM Analysis

DISCUSSION OF KEY FINDINGS

To the best of our knowledge, there have been no published studies that have applied the visual perception theories to online banner ads and click-through rates. Motivated by this lack of research, we developed the Visual Perception (VP) Model. The theoretical background for the VP model is the visual perception theories. The VP model helps to explain factors that might improve online banner ad click-through rates. SEM analysis as shown in *Figure 7* indicates that perceived usefulness of online banner ads explains 60 percent of the intention to click online banner ads. Perceived security of online banner ads and match between web user's need and banner ad content explain 69 percent of perceived usefulness of online banner ad.

Perceived usefulness of online banner ads (H1) has a positive and significant effect on the intention to click online banner ads. Perceived security of online banner ads (H2) has a positive and significant effect on perceived usefulness of online banner ads. Match between web user's need and banner ad content has a positive and significant effect on perceived usefulness of online banner ads. The hypotheses (i.e. H1, H2, and H3) suggest that web users click online banner ads if they perceived that the banner ad is useful, secure, and personalized.

Implications for Research and Practice

To the best of our knowledge, our study is the first study that has employed the visual perception theories to predict and explain the behavioral intention to click online banner ads by developing the Visual Perception (VP) Model. Hence, our study contributes to the adoption literature that will help to stimulate future research to investigate other factors using the visual

perception theories that might help to explain why online banner ad click-through rates have been decreasing consistently for the past two decades.

Our study has important implications for IS practice, especially within the context of target marketing and ecommerce by providing insights and understanding on specific factors that might improve click-through rates, online revenues, and sales. Also, it provides insights to banner ad designers on critical factors to consider when designing online target marketing. For example based on the hypotheses that were supported, our study implies that banner ads with security policy displays and content that matches web users' immediate needs are perceived by web users to be useful. Also, the hypotheses indicate that displaying banner ads with the wrong content and at the wrong time causes web users and/or online visitors to have an undesirable and negative impression toward specific online banner ads. Finally, the findings of our study explain how the intentions to click online banner ads are influenced by perceived usefulness of banner ads.

Summary

For the past two decades, banner ad click-through rates have been declining continuously, and to address this issue, there have been many published articles in the information systems, computer science, and marketing disciplines relating to animation of online banner ads and mathematical models that personalized online ads. To the best of our knowledge, there are no published articles that have investigated the application of visual perception theories to online banner ad click-through rates. Hence, our study develops the VP Model to help explain factors that influence the intention to click online banner ads. The theoretical foundation for the VP Model is the visual perception theories. The VP Model gives insight on important factors for future researchers to consider when investigating the behavioral intention to use a wide range of information technology platforms. Also, the VP Model has research and practical implications.

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