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ORIGINAL RESEARCH

The impact of formats and interactive modes on the effectiveness of mobile advertisements

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Abstract Mobile advertising researchers have suggested that the advertising effect is caused by the advertising features. However, research on mobile advertising effectiveness is scant. This article explores advertising formats and interactive modes related to the effectiveness of advertising by adopting the attention, interest, desire and action (AIDA) model. This utilized an experimental procedure and questionnaire. The analysis of variance (ANOVA) results showed a significant format and interactive mode effect, but no interaction between the format and interactive modes. Moreover, rich media showed higher advertising effectiveness than the dynamic banner. The playfulness interactive mode was better than user control and connectedness on advertising effectiveness. In conclusion, this study provided results that promote consumer's willingness to buy. Rich media and playfulness interactive advertising modes should be adopted.

Keywords ANOVA · Mobile advertising · Interactive mode · Advertising effectiveness · AIDA model

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1 Introduction

With the increasing popularity of smart phones, this technology has become indispensable to the daily life of many people. Most mobile advertisements were voice and text messages in the past. Mobile phone advertising has now moved into location-based services (LBS) and multimedia advertising. The rise of smartphones has opened another competition channel in the market for mobile advertising. The smartphone is just getting started. In 2010 the number of smartphones was 1.72 billion with an annual growth rate of 23.8 %. In 2015 this number will increase to 2.5 billion. There are many applications available for the smart-phone (Choi et al. 2011), such as the many programs in the mobile application (APP) store. The APP has become the main distribution method for media on mobile phones (Prodhan 2012). The mobile advertising type is different from the traditional one-way advertising. Users have a profound impression through interactive advertising, which is considered the business field of the future. Gartner (2013) proposed the worldwide mobile application advertising revenue is forecast to reach $11.4 billion in 2013, up from $9.6 billion in 2012. The mobile application store revenue is expected to reach US $74 billion in 2016, up from US $15 billion last year.

According to prior research Lee (2009) defined mobile advertising is a source for consumers to select products, thus, advertising presentation is the critical factor in decision-making regarding product selection. Mobile display advertisements refer to banner advertisements, video placements and other rich media experiences, which are thought to be more engaging and more valuable to advertisers (Fiegerman 2012). On the other hand, Pavlou and Stewart (2002) considered that interactive advertising

can make users quickly understand the meaning of this advertising. Gao et al. (2010) defined that a better understanding of mobile advertisement interactivity is important for those who want to utilize the interactive nature of this medium more effectively, providing information tailored to the user based on effective communication. Interactive advertising has been considered to increase the efficiency of users' involvement and satisfaction, and produce trustworthiness and quality in advertising.

Most of the above studies focused on Internet advertising have generated a considerable number of findings. Internet advertising is a form of marketing and advertising that uses the Internet to deliver promotional marketing messages to consumers. It includes email, search engine, social media and many types of display advertising (including banner advertising), and mobile advertising (Ha 2008). Few studies examine the characteristics of advertising effectiveness and propose an effective design guideline for mobile advertising. In recent years many researches on mobile application advertising have discussed advertising effectiveness. The purpose of this study is to explore the advertising effectiveness of presentation formats and interactive modes in mobile application advertising. Scales for different presentation formats and different interactive modes are needed to help researchers understand the effectiveness of mobile application advertising, to help advertisers benefit from the potential of new mobile application advertising tools.

This study identified the best combination of presentation formats and interactive modes for mobile application advertising. The results from this research are intended to provide a reference for advertisers and advertising platform providers.

The objectives in this study are listed below:

1. Explore the effects of formats on smartphone mobile application advertising.
2. Explore the effects of interactive modes on smartphone mobile application advertising.
3. Explore the effects of two formats and three interactive modes on smartphone mobile application advertising.
4. Propose formats and interactive modes for mobile application advertising.

This study proposes the motivation and objectives in the Sect. 1. Section 2 introduces the literature review. Section 3 describes the research methodology and experiments. The study results are described in the Sect. 4. Section 5 presents the discussion. Conclusions are presented in Sect. 6.

2 Literature review

In this chapter the study background and related research are presented. Descriptions of mobile advertising, interactive advertising and advertising effectiveness are also presented.

2.1 Mobile advertising

The definition of mobile advertising is the distribution of advertising messages to the targeted demographic' handsets in formats of music, graphics, text or voice in order to reach advertisers' goals as well as to gather consumer feedback (Nelson 2000). Compared with traditional marketing, mobile advertising could provide customized information involving time, location and interests, as related to the consumers (Barnes and Scornavacca 2004). According prior research on mobile advertising, which enables consumers to access a variety of services: Web information search, short message service (SMS), multimedia message service (MMS), banking, payment, gaming, e-mailing, chat, weather forecast, global positioning service (GPS) (Tripathi and Siddiqui 2008). Therefore, this study determined two essential elements of mobile advertising: mobile devices and wireless environments (Hu 2012).

Shuang (2010) referred that with the development of 3rd-Generation (3G) and Wi-Fi, the increase in bandwidth makes transferring images and video possible. Mobile device users can receive digital photos, video images and high-quality audio from their mobile phones. This mobile communication feature that can be used for personalized marketing, leading advertisers to locate better brand images and increase purchasing rates for their services and products (Lee et al. 2006). Mobile advertising is summarized into four basic categories: (1) personalization; (2) interactivity; (3) location-based, and (4) real-time.

2.1.1 Classifications and formats of advertising

MMA (2015) the transmission medium for mobile advertising is divided into (1) mobile web; (2) mobile application; (3) mobile messaging, and (4) mobile video. With the evolution of mobile advertising formats the most frequent delivery formats for advertising presentation are SMS (short message service), URL (uniform resource locator) callback, MMS (multimedia messaging system), directory service, coupon and advertising banner (Lee et al. 2006a, b).

New advertising presentation formats have been designed for better user-oriented services and interfaces. There are seven types of formats: (1) short message service (SMS); (2) multimedia messaging system (MMS); (3) URL

callback; (4) video service; (5) code, hot number; (6) M-mail, and (7) banner. In addition to advertising presentation format that advertisers use for presenting advertising on the mobile device, classification occurs more frequently in advertisement content types (static or dynamic), advertising formats (banner advertising, rich media advertising, expandable advertising, etc.), as well as the advertising channels (mobile advertising, mobile application, mobile Web sites and video) (Hoffman and Novak 1996; MMA 2015). Wang (2003) claimed that mobile advertising formats have an impact on advertising effectiveness and multimedia effects formats that can increase the effectiveness of advertising persuasion.

2.2 Interactive advertising

Interactivity has been widely discussed in the fields of the advertising, marketing, communication, information science, computer science and education (McMillan and Hwang 2002). Raman (1996) proposed that interactivity provides flexibility in the choice of information for consumers, allowing consumers to respond by modifying the contents of the instruction. The ideal interaction is based on face-to-face interpersonal communication indicators. McMillan and Hwang (2002) categorized the definitions of interactivity based on process, features and perception.

Interactive mobile advertising media is considered to have the most potentially persuasive tools whether context-sensitive, user interface or communication with consumers, which cannot be compared with the traditional advertisement. Interactive advertising provides users more control by giving them a range of choices in their experience with mobile advertising (Lombard and Snyder-Duch 2001). Mobile handheld devices are mobile, nearly always on and response convenient (Barnes 2002), which allows the advertisers to communicate with their customers in a personal and interactive style. A better understanding of interactivity is of critical importance for those who want to analyze and/or develop Web-based advertising (McMillan and Hwang 2002). The importance of interactivity will increase in mobile advertising because it is one of the most salient characteristics of mobile communications (Rettie and Brum 2001). Gao et al. (2006) proposed six interactivity constructs for mobile advertisements:

1. User control

Mobile advertisements are characterized by voluntary and instrumental action that directly influences the controller's experience.

2. Two-way communication

It refers to the ability for reciprocal communication between companies to users, and users to users.

3. Synchronicity

It refers to the degree to which users' input into a communication and the responses they receive from the communication are simultaneous.

4. Connectedness

Interactivity should be defined in terms of the extent to which the communicator and the audience respond to, or are willing to facilitate each other's communication needs (Ha and James 1998).

5. Playfulness

Playfulness is empirically proven to be a salient predicator for website popularity (Chen and Yen 2004).

6. Interpersonal communication

Interpersonal communication is the process of sending and receiving information between two or more people. In interactivity literature, interpersonal communication has long been defined as the ideal type or the standard of interactive communication (Durlak 1987; Williams et al. 1988; DeFleur and Ball-Rokeach 1989; Heeter 1989).

2.3 Advertising effectiveness

With the development of communications advertising can create value for customers. Advertising and marketing communications go to work only for the purpose of increasing sales, but today advertising is considered one of the most important elements of customer service (Gharibi et al. 2012). Advertising has been created for marketers to promote their products and services. Thus, measuring whether online advertising is effective with it's' target consumers is crucial (Ju 2013).

2.3.1 AIDA model

The attention, interest, desire and action (AIDA) model presented by Elmo Lewis in 1898 (Strong 1925), provides a sophisticated illustration about the entire process of how advertising affects consumer behavior (Pomoni 2010). Wijaya (2012) purposed that proponents of the traditional hierarchy framework suggest that audiences respond to messages in a very ordered way that is first cognitive (thinking), then affective (feeling) and thirdly action (doing).

AIDA model considers consumer response as a movement through a sequence of stages (thinking–feeling–doing) assuming that cognitive maturity precedes affective reaction which precedes behavior and moves from attention to interest, then desire and finally action. (Pomoni 2010) (Fig. 1). Thus, advertisers should be cognizant of

Fig. 1 Hierarchy of AIDA model

how their target market is distributed across the continuum stages (Schaefer et al. 2010).

Advertisers must be able to give consumers reassurance that their decision is correct and also that people should be able use words to provide advertising content words when talking with others about the product (Bendixen 1993). The enormous amount commercial enterprises spend on advertising indicates the importance of advertising in advance (Gharibi et al. 2012). In this study the AIDA model is presented for measuring the effectiveness of advertising. This model includes four stages:

1. Attention

To attract attention (and awareness) means that before you sell something you need to attract his attention (Barry and Howard 1990).

2. Interest

Generate interest in the client; this means demonstrating product features and benefits, people get interested in their product. Music and promoted language should fit well with experience and attitudes of customers (Barry and Howard 1990).

3. Desire

To create enthusiasm in the people is very important. The advertiser must know how to target customers. The advertising message must be able to convince customers that the intention is to introduce and supply goods that will fulfill the customer's needs (Barry and Howard 1990).

4. Action

The last step is to end the purchase or sale. At this stage you want the customer to know about buying and take this final decision to end the process (Barry and Howard 1990).

3 Research methodology

This study follows previous research to explore possible variables and then plan the experimental design. The session includes: research framework, participants, experimental equipment, experimental design, and experimental procedure.

3.1 Research model and variables

This study suggested a research model to analyze an interaction between formats (i.e., dynamic banner advertising and rich media advertising), interactive modes (i.e., user control, connectedness, and playfulness) to have an enhancing effect on advertising effectiveness. The research model of the study probed into the advertising effects that fit between advertising formats and interactive modes (Fig. 2).

3.1.1 Relationship between formats and advertising effectiveness

Previous studies have shown that advertising formats have an impact on advertising effectiveness. LeeSing and Miles (1999)found that media presentation has a significant difference in their presentation efficiency. Burns and Lutz (2006) found that the nature of the on-line advertising format is an important characteristic that influences on-line advertising response. Brunyé et al. (2007) compared the effectiveness of different multimedia combinations (i.e. pictures with accompanying texts) to single-format (i.e. picture- or text-only) presentations on the comprehension. The results in this study show that multimedia effectively presents procedural information. Based on the current findings, multiple media formats are more effective than simple formats on the effectiveness of advertising. Wu et al. (2008) showed that dynamic advertising delivers better value than static advertising on advertising effectiveness. Thus, the present experiment examined multimedia advertising formats represented by the dynamic banner advertising and the rich media advertising.

1. Dynamic banner advertising

The form of banner advertising on mobile applications advertising is used of text and dynamic graphic presentation, a lower level of multimedia advertising model (Hu 2012).

2. Rich media advertising

The form of richness advertising in mobile applications advertising uses animation, sound, text and interactive presentation style, a higher level of multimedia advertising model (Hu 2012).

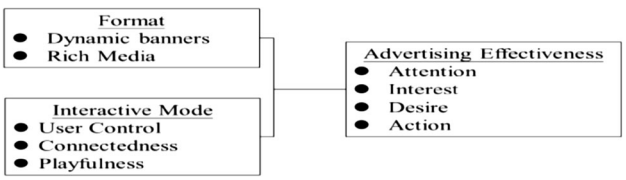

Fig. 2 Research model

3.1.2 Relationship between interactive modes and advertising effectiveness

According to previous research on interactivity, it is generally considered to be the central characteristic of new media. Cutler (1990) defined new interactive media as media that provides the opportunity to instantaneously advertise, execute a sale, and collect payment. The use of interactive advertising through new media draws attention to the contrast. It was between traditional assumptions about advertising and its effects and the realities of communication in the market place (Pavlou and Stewart 2002).

Gao et al. (2006) indicated that interactivity could benefit mobile advertisement effectiveness. This research results showed that various interactive features of mobile advertisements have significant influences on users' perceived interactivity. The research focused on interactive features and user perception to identify general characteristics (such as user control and two-way communication).

Wandell (2011) and Bilton (2013) identified some tips for better advertising in mobile applications. These studies indicated that important interactivity features of mobile application advertising were user control, connectedness and playfulness. Thus, the present experiment is integrated the concepts of interactive mode of mobile advertising, and it is represented by user control, connectedness, and playfulness.

1. User control construct

It is drawn from the range and control dimensions of interactivity (Steuer 1992) and applied to the context of mobile applications.

2. Connectedness construct

It is conceptualized based on the feedback function (Ha and James 1998) and transaction facilitation (Song and Zinkahn 2008).

3. Playfulness construct

It is added from the interactivity literature on Web environment and mobile advertisement (i.e., entertainment) (Gao et al. 2010).

3.2 Experimental design

The study invited 30 participants to participate in this study. They were randomly assigned to six experimental groups. Six sets of questionnaires were assigned for these experimental groups. The advertising format is set to between-subject factor, and the advertising interactive mode is set to the within-subject factor. Table 1 shows that random assignment of the participants per experimental group. The experimental groups: Dynamic banner advertising with user control, dynamic banner advertising with connectedness, and dynamic banner advertising with playfulness. The participants of the experiment: rich media advertising with user control, rich media advertising with connectedness, and rich media advertising with playfulness. Table 2 shows the six types of advertisements, including advertisements for cars, food, mobile phones, games and movies.

Table 1 Design of experimental group

No.	Format	Conduct	Participant
1	Dynamic banner	User control	15
2		Connectedness	
3		Playfulness	
4	Rich media	User control	15
5		Communication	
6		Playfulness	

3.2.1 Apparatus

This study used the HTC Sensation XE as the experimental apparatus. It has a capacitive multi-touch screen and 540 × 960 (4.3 inches) pixels resolution.

3.2.2 Participants

The participants in this experiment were 30 undergraduate and graduate students (age range 21–30 years old), including 18 males and 12 females. The participants were smartphone users with experience using mobile application advertising. The experimental results were not affected by improper smartphone operation.

3.2.3 Questionnaire design

In these experiments the measure adopted the AIDA questionnaire by Lin (2012), Schaefer et al. (2010) and Van der Waldt et al. (2007). Part II was delivered to the participants after they operated the mobile application advertising on the smartphone. This part used 14 seven-point Likert-scale items (7 for "strongly agree" to 1 for "strongly disagree" to address four main AIDA constructs (i.e., attention, interest, desire and action).

Table 2 Experimental advertisements

No.	Construct	Dynamic banner	Rich media
1	User Control	 (Mobile Phone Advertisement)	 (Car Advertisement)
2	Connectedness	 (Food Advertisement)	 (Game Advertisement)
3	Playfulness	 (Car Advertisement)	 (Movie Advertisement)

3.3 Experimental procedure

The experimental procedure is as follows:

1. The researcher described the experimental procedure and operation.
2. The participant was given a mobile phone to become accustomed to the phone interface operation. The subject was given five minutes interface acclamation time.
3. The participants were randomly assigned one of the mobile application advertisements in the six experimental conditions and performed the experiment to determine advertising effectiveness. The mobile advertising operation required 5 min of experimental time each time.
4. When the experiment was completed the participant filled out a questionnaire.
5. The participant was given rest for 1 min.
6. Steps (3–5) were repeated until experiment completion.

All experimental groups required 15 min to finish the experiment.

4 Result

4.1 Participants demographic data

This study recruited 30 participants for these experiments. They are 18 males and 12 females. The participants were familiar with operating a smartphone and had experience receiving mobile advertisements. The descriptive statistics are shown in Table 3.

4.2 AIDA reliability analysis

This study used reliability analysis to ensure that all questions were internally consistent. The Cronbach's α coefficient reliability measured the AIDA questionnaire items. The Cronbach's α values ranged from 0 to 1. The α value closest to 1 indicates higher reliability. Cronbach's α coefficient were calculated to see the internal consistencies between the scales shown in the analysis and the total scale scores. According to the results, all figures were higher than 0.80, which indicates high reliability. Cronbach's α coefficients were 0.912 for the complete scale, 0.879 for attention, 0.882 for interest,

Table 3 Descriptive statistics

Type	Item	Number	Percentage (%)
Sex	Male	18	60
	Female	12	40
Age	21–25	24	80
	26–30	6	20
Education	Universities and Colleges	3	10
	Graduate School	27	90
Occupation	Students	30	100
Time of using smartphone	Less than 1 year	13	43
	1–2	11	37
	2–3	5	17
	Over 3 years	1	3

Table 4 AIDA reliability analysis

Factor	Items	Cronbach's alpha	Overall Cronbach's alpha
Attention	Att01	0.838	0.879
	Att02	0.849	
	Att03	0.857	
	Att04	0.847	
Interest	Int01	0.850	0.882
	Int02	0.867	
	Int03	0.867	
	Int04	0.810	
Desire	Des01	0.933	0.898
	Des02	0.919	
	Des03	0.887	
Action	Act01	0.889	0.852
	Act02	0.866	
	Act03	0.823	
Overall Cronbach's alpha			0.912

0.898 for desire, 0.852 for action to the mobile advertising. The AIDA questionnaire details are shown in Table 4.

4.3 Questionnaire analysis

The rich media advertising format in playfulness interactive mode [mean = 6.08, stand deviation (SD) = 1.24] produced higher advertising effectiveness mean compared with the other interactive mode groups. The results are shown in Table 5. The overall mean score for the dynamic banner advertising format is 4.84; SD is 1.45. The overall mean score for the rich media advertising format is 5.76 with and SD of 1.09. In terms of interactive mode, it includes three sub-constructs, namely (1) user control (mean = 5.14, SD = 1.65); (2) connectedness (mean = 5.39, SD = 1.45); (3) playfulness (mean = 5.72, SD = 1.25).

The rich media advertising format on playfulness interactive mode (mean = 6.03, SD = 0.96) produced

Table 5 Mean scores for attention advertising effectiveness

	User control		Connectedness		Playfulness		Overall	
	M	SD	M	SD	M	SD	M	SD
Dynamic banner ad	4.50	1.71	5.15	1.63	5.35	1.16	4.84	1.45
Rich media ad	5.78	1.30	5.63	1.19	6.08	1.24	5.76	1.09
Overall	5.14	1.65	5.39	1.45	5.72	1.25		

Table 6 Mean scores for interest advertising effectiveness

	User control		Connectedness		Playfulness		Overall	
	M	SD	M	SD	M	SD	M	SD
Dynamic banner ad	4.65	1.64	5.07	1.58	5.32	1.17	4.84	1.41
Rich media ad	5.78	1.25	5.60	1.50	6.03	0.96	5.76	1.13
Overall	5.21	1.56	5.33	1.58	5.81	1.12		

Table 7 Mean scores for desire advertising effectiveness

	User control		Connectedness		Playfulness		Overall	
	M	SD	M	SD	M	SD	M	SD
Dynamic banner ad	4.42	1.47	4.60	1.60	5.36	1.38	4.79	1.53
Rich media ad	5.78	1.35	5.51	1.34	5.96	1.07	5.75	1.26
Overall	5.1	1.56	5.06	1.54	5.66	1.26		

Table 8 Mean scores for action advertising effectiveness

	User control		Connectedness		Playfulness		Overall	
	M	SD	M	SD	M	SD	M	SD
Dynamic banner ad	4.36	1.68	4.96	1.77	4.91	1.73	4.74	1.74
Rich media ad	5.38	1.70	5.42	1.70	5.71	1.22	5.50	1.55
Overall	4.87	1.76	5.20	1.74	5.31	1.54		

higher mean of advertising effectiveness compared with the other interactive mode groups. The results are shown in Table 6. The overall mean score for the dynamic banner advertising format is 4.84; (SD) is 1.41. The overall mean score for the rich media advertising format is 5.76 with and SD of 1.13. In terms of interactive mode, it includes three sub-constructs, namely (1) user control (mean = 5.21, SD = 1.56); (2) connectedness (mean = 5.33, SD = 1.58); (3) playfulness (mean = 5.81, SD = 1.12).

The rich media advertising format, for playfulness interactive mode (mean = 5.96, SD = 1.07) produced higher mean advertising effectiveness compared with the other interactive mode groups. The results are shown in Table 7. The overall mean score for the dynamic banner advertising format is 4.79; SD is 1.53. The overall mean score for the rich media advertising format is 5.75 with and SD of 1.26. In terms of interactive mode, it includes three sub-constructs, namely (1) user control (mean = 5.1, SD = 1.56); (2) connectedness (mean = 5.06, SD = 1.54); (3) playfulness (mean = 5.66, SD = 1.26).

The rich media advertising format for playfulness interactive mode (mean = 5.71, SD = 1.22) produced higher mean advertising effectiveness compared with the other interactive mode groups. The overall mean score for the dynamic banner advertising format is 4.74; SD is 1.74. The results are shown in Table 8. The overall mean score for the rich media advertising format is 5.50 with and SD of 1.55. In terms of interactive mode, it includes three sub-constructs, namely (1) user control (mean = 4.87, SD = 1.76); (2) connectedness (mean = 5.20, SD = 1.74); (3) playfulness (mean = 5.31, SD = 1.54).

Table 9 Format difference on factors for advertising effectiveness

	Format	Mean	SD	t value
Attention	Dynamic banner	4.84	1.45	−2.587*
	Rich media	5.76	1.09	
Interest	Dynamic banner	4.84	1.41	−2.573*
	Rich media	5.76	1.13	
Desire	Dynamic banner	4.79	1.53	−2.516*
	Rich media	5.75	1.26	
Action	Dynamic banner	4.74	1.74	−2.381*
	Rich media	5.50	1.55	

* Is shown the significant

4.4 The effects of formats on mobile application advertising

The *t* test results are shown in Table 9. There are significant differences in the advertising presentation formats for advertising effectiveness. Rich media advertising shows higher attention, interest, desire and action than dynamic banner advertising.

The one-way analysis of variance (ANOVA) results were the p values (Sig.) from the F test in the ANOVA table are smaller than 0.05, implying that there are significant differences among the groups on the attention scales [F (1, 29) = 6.695, $p < 0.05$], interest [F (1, 29) = 6.618, $p < 0.05$], desire [F (1, 29) = 6.329, $p < 0.05$], and action [F (1, 29) = 5.670, $p < 0.05$].

4.5 The effects of formats and interactive modes on mobile application advertising

The results indicated that significant differences occur among the three interactive modes on attention advertising effectiveness [F = 9.206, $p < 0.05$] and interest [F = 11.472, $p < 0.05$] except desire [F = 19.259, $p < 0.05$] and action [F = 3.090, $p > 0.05$]. In addition, the mixed design two-way ANOVA results show no significant different interactions between the formats and interactive modes on advertising effectiveness.

Table 10 Pairwise comparisons for the subscale on interactive modes

Dependent variable	(I) Interactive mode	(J) Interactive mode	Mean difference (I − J)	P value
Attention	User Control	Connectedness	-0.133	0.585
		Playfulness	-0.625	0.011*
	Connectedness	User control	0.133	0.585
		Playfulness	-0.492	0.045*
	Playfulness	User control	0.625	0.011*
		Connectedness	0.492	0.045*
Interest	User control	Connectedness	−0.017	0.954
		Playfulness	-0.542	0.027*
	Connectedness	User control	0.017	0.954
		Playfulness	-0.525	0.032*
	Playfulness	User control	0.542	0.027*
		Connectedness	0.525	0.032*
Desire	User control	Connectedness	-0.122	0.633
		Playfulness	-0.644	0.013*
	Connectedness	User control	0.122	0.633
		Playfulness	-0.767	0.003*
	Playfulness	User control	0.644	0.013*
		Connectedness	0.767	0.003*
Action	User control	Connectedness	-0.223	0.445
		Playfulness	-0.495	0.087
	Connectedness	User control	0.278	0.340
		Playfulness	-0.223	0.445
	Playfulness	User control	0.495	0.087
		Connectedness	0.278	0.340

* Is shown the significant

Table 10 shows the pairwise comparison method results. The results indicate that the playfulness interactive mode shows more positive responses on advertising effects. It shows significant differences exist between the interactive user control mode and the playfulness mode on advertising effectiveness for attention, interest and desire. Significant differences also exist between the interactive connectedness and playfulness modes for attention, interest and desire. No significant difference exits for all interactive modes on action advertising effectiveness.

5 Discussion

In this section this study presents the experimental results.

1. Mobile application advertising formats

The overall mean advertising effectiveness is higher than that for dynamic banner advertising. The participants agree that the rich media format is more engaging than dynamic banner advertising (p value $= 0.005 < 0.05$). Users can browse the rich media advertising format with more interest than for the dynamic banner advertising (p value $= 0.016 < 0.05$). After reading mobile advertising users crave more product information in rich media advertising format than dynamic banner advertising (p value $= 0.018 < 0.05$). The rich media advertising format is more effective than dynamic banner advertising (p value $= 0.024 < 0.05$) to buy. Just as Lee (2009) indicated, rich media information media allows the user to interact with the advertising information. A high level of richness is able to effectively transmit the multimedia information.

The results correspond to Wang (2003) and Wu et al. (2008) claimed that the mobile advertising format has an impact on advertising effectiveness. This study concluded that the rich media mobile application advertising format is more effective.

2. Interactive mobile application advertising modes

This study analyzed the average effect between the interactive playfulness and user control and connectedness modes on advertising effectiveness.

The difference (−0.625) between the average interactive mode effect for user control and playfulness was analyzed statistically significant at the 0.05 level. The difference (−0.542) between the average interactive mode effect for

user control and playfulness was analyzed statistically significant at the 0.05 level. The difference (−0.644) between the average interactive mode effect for user control and playfulness was analyzed statistically significant at the 0.05 level. The difference (−0.767) between the average interactive mode effect for connectedness and playfulness was analyzed statistically significant at the 0.05 level.

This study therefore concluded that the interactive playfulness mode is better than the other interactive modes. These results correspond to Gao et al. (2010) who claimed that users expect to choose more freely with real-time and playful mobile advertising interactions on their handheld devices. Although the interactive mode showed no significant differences on in advertising desire and action effectiveness, this is because the participants must consider whether they need the product requirements and other reasons to buy.

The results show on the interaction between the formats (i.e., dynamic banner advertising and rich media advertising) and interactive modes (i.e. user control, connectedness, and playfulness) that no significant differences were found on advertising effectiveness. However, the overall mean for formats and interactive modes on advertising effectiveness for attention, interest, desire and action were higher than four. As a result, the participants tended to have a positive attitude toward these mobile application advertising experiments.

The limitations of this study were subject to insufficient manpower, material resources and time. These experiments were conducted in a laboratory and the strained atmosphere made it difficult to simulate the real world environment. Therefore, this may influence the experimental results. Both brand recall and brand attitude are critical measurable indicators for the effectiveness of advertising, but this study's questionnaire did not include in items in the advertising effectiveness measurement. Finally, due to time limits, this study did not explore the long-term effects of mobile application advertising for the experimental combination.

6 Conclusions

The main purpose of this study was to identify what mobile application advertising formats did users really like and accept. What mobile application advertising interactive modes are really suitable for general users. This research identified the relationship between formats and interactive modes in mobile application advertising on advertising effectiveness. This study is summarized as follows:

1. The presentation format in this study is divided into two advertising formats (dynamic banner advertising and rich media advertising). According the analytical result, this study discovered that participants respect mobile advertising richness, which is identical to the research results of Li and Leckenby (2004). It shows that more attractive rich media fits highly with mobile advertising will create higher interest, desire and thereby induce consumers' willingness to purchase.
2. This research measured mobile effectiveness from the mobile application advertising interactive modes (user control, connectedness, and playfulness). The analytical result of this research found a relationship between interactive advertising and advertising effectiveness. The playfulness interactive mode made users feel interested and amused, increasing their willingness to purchase.
3. According to prior research, no identical view was found on the influences of formats and interactive modes on advertising effectiveness in mobile advertising. The analytical result from this research shows a positive correlation between the format and interactive mode. We therefore believe that it is important to advertising effectiveness.

References

Barnes S (2002) The mobile commerce value chain: analysis and future developments. Int J Inf Manage 22:91–108

Barnes SJ, Scornavacca E (2004) Mobile marketing: the role of permission and acceptance. Int J Mobile Commun 2(2):128–139

Barry TE, Howard DJ (1990) Are view and critique of hierarchy of effects in advertising. Int J Advert 9(1):121–135

Bendixen MT (1993) Advertising effect and effectiveness. Eur J Market 27(10):19–32

Bilton R (2013) Nuance uses its voice smarts to create interactive and entertaining mobile ads. http://venturebeat.com/2013/04/01/nuance-voice-ads-launch/. Accessed 1 Jan 2015

Brunyé TT, Taylor HA, Rapp DN (2007) Repetition and dual coding in procedural multimedia presentations. Appl Cogn Psychol 22(7):877–895

Burns KS, Lutz RJ (2006) The function of format: consumer responses to six identity. J Acad Market Sci 34(1):74–83

Chen K, Yen D (2004) Improving the quality of online presence through interactivity. Inf Manag 42(1):217–226

Choi H, Choi YJ, Kim KM (2011) The understanding of building trust model on smartphone application: focusing on users' motivation. In: Proceedings of the international conference on it convergence and security, lecture notes in electrical engineering, pp 12–30

Cutler B (1990) The fifth medium. Am Demogr 12:24–29

DeFleur ML, Ball-Rokeach SJ (1989) Theories of mass communication. Longman, New York

Durlak JT (1987) A typology for interactive media. Commun Yearb 10:743–757

Fiegerman S (2012) Why are mobile ads so cheap. http://mashable.com/2012/10/23/mobile-ad-prices/. Accessed 1 Jan 2015

Gao Q, Rau PLP, Salvendy G (2006) Measuring perceived interactivity of mobile advertisements. Behav Inf Technol 29(1):35–44

Gao Q, Rau PLP, Salvendy G (2010) Perception of interactivity: affects of four key variables in mobile advertising. J Hum Comput Interact 25(6):479–505

Gartner (2013) Gartner says worldwide mobile advertising revenue to reach $11.4 billion in 2013. http://www.gartner.com/newsroom/id/2306215. Accessed 1 Jan 2015

Gharibi S, Danesh SYAHYAHS, Shahrodi K (2012) Explain the effectiveness of advertising using the AIDA model. Interdiscip J Contemp Res Bus 4(2):926–940

Ha L (2008) Online advertising research in advertising journals: a review. J Curr Issues Res Advert 30(1):31–48

Ha L, James E (1998) Interactivity re-examined: an analysis of business web sites. In: Muehling DD (ed) Proceedings of the 1998 conference of the american academy of advertising, Washington State University, Pullman, Washington

Heeter C (1989) Implications of new interactive technologies for conceptualizing communication. In: Salvaggio JL, Bryant J (eds) Media use in the information age: emerging patterns of adoption and computer use. Lawrence Erlbaum Associates, Hillsdale, pp 217–235

Hoffman LD, Novak PT (1996) Marketing in hypermedia computer-mediated environments conceptual foundations. J Market 60:50–68

Hu TT (2012) The influence of positions and formats of mobile applications on the advertising effectiveness of smartphones. Institute of Communication Management and National Sun Yat-Sen University

Ju B (2013) A proposed cross-cultural examination of online advertising effectiveness in China and the UK. Int J Bus Manage 8(6):34–39

Lee CC (2009) Presentation effects of mobile advertising—product categories and advertising formats fit. In: Proceedings of the 2009 8th international conference on mobile business, pp 120–125

Lee HS, Lee CH, Lee GH, Kim YH, Lee GB (2006) Analysis of the actual response rates in mobile advertising. Innovations in Information Technology, 1-5 Nov. doi:10.1109/INNOVATIONS.2006.301933

Lee JW, Lee CS, Park YS (2006) Research on the advertisement effect of push type mobile advertisement. In: Proceeding of 2009 4th international conference on cooperation and promotion of information resources in science and technology, pp 137–142

LeeSing AC, Miles CA (1999) The relative effectiveness of audio, video, and static visual computer-mediated presentations. Can J Educ 24(3):212–221

Li H, Leckenby JD (2004) Internet advertising formats and effectiveness. http://brosephstalin.files.wordpress.com/2010/06/ad_format_print.pdf. Accessed 1 Jan 2015

Lin HF (2012) The impact of customized and interactive feature of mobile advertising on persuasion. In: Annual conference of the Chinese communication society. Abstract retrieved from http://140.119.187.23/conference/paper/0000061755552262012.pdf

Lombard M, Snyder-Duch J (2001) Interactive advertising and presence: a framework. J Interact Advert 1(2):56–65

McMillan SJ, Hwang JS (2002) Measures of perceived interactivity: an exploration of the role of direction of communication, user control, and time in shaping perceptions of interactivity. J Advert 31(3):29–42

Mobile marketing association [Online]. http://www.mmaglobal.com/main. Accessed 1 Jan 2015

Nelson R (2000) Interactive advertising: new revenue streams for fixed and mobile operators. An Ovum Report, May 2000

Pavlou PA, Stewart DW (2002) From consumer response to active consumer: measuring the effectiveness of interactive media. J Acad Mark Sci 30(4):376–396

Pomoni C (2010) Investigating the hierarchy of effects model in advertising. http://voices.yahoo.com/investigating-hierarchy-effects-model-advertising-7076318.html?cat=3. Accessed 1 Jan 2015

Prodhan G (2012) Apps become important to mobile advertising—report. http://www.reuters.com/article/2012/04/20/mobile-advertising-apps-idUSL6E8FKHHZ20120420. Accessed 1 Jan 2015

Raman N (1996) Determinants of desired exposure to interactive advertising. University of Texas at Austin

Rettie R, Brum M (2001) M-commerce: the role of SMS text messages. In: Proceedings of the 4th biennial international conference on telecommunications and information markets (COTIM 2001), Karlsruhe, Germany

Schaefer A, Parker RS, Haytko D (2010) Chinese and U.S. consumers' perceptions of the effectiveness of celebrity athlete endorsers. J Manage Market Res 2(1):1–9

Shuang X (2010) A conceptual framework for consumer adoption of mobile advertising in China. In: 2010 international conference on e-business and e-government, pp 74–77

Song JH, Zinkahn GM (2008) Determinant of perceived web site interactivity. J Market 72(2):99–113

Steuer J (1992) Defining virtual reality: dimensions determining telepresence. J Commun 42:73–93

Strong EK (1925) Theories of selling. J Appl Psychol 9:75–86

Tripathi NS, Siddiqui HM (2008) Effectiveness of mobile advertising: the Indian scenario. Vikalpa 33(4):47–59

Van der Waldt DLR, De Beer N, Du Plessis N (2007) Attitudes towards attractive and credible celebrities in advertisements: a survey amongst students. Comunicare 26:44–58

Wandell T (2011) 5 tips for better advertising in mobile apps. http://mashable.com/2011/03/11/mobile-app-advertising/. Accessed 1 Jan 2015

Wang JH (2003) The effects of advertising exposures on mobile advertisement. Retrieved from The Institute of Telecommunications Management and National Cheng Kung University

Wijaya BS (2012) The development of hierarchy of effects model in advertising. Int Res J Bus Stud 5(1):73–85

Williams F, Rice R, Rogers E (1988) Research methods and the new media. Free Press, New York

Wu KL, Hu AN, Huang LY (2008) The effects of multimedia message service on mobile advertisement. Market Rev 5(4):481–583