Executive Summary

Conclusions

This study showed significant effect of advertising units (banners, interstitials, integrated Ads) on customer satisfaction and advertisement recall. Interstitials and integrated Ads were found to lead to increased satisfaction when compared with banners. The customer satisfaction difference between interstitials and integrated Ads was not significant. No significant difference was found in recall during pairwise comparisons of the three advertising units.

Recommendations

We recommend stakeholders who value both customer satisfaction and ad revenue to use either interstitials or integrated Ads.

(1) Interstitials and integrated Ads are better than banners. These two units had higher customer satisfaction and had similar amount of recall as banners did in our experiment.

(2) There is no significant difference between interstitials and integrated advertisements in customer satisfaction and advertising effectiveness. In our experiment of satisfaction and recall, no evidence suggested either unit was better than the other.

Methods

The conclusion and recommendations were drawn from a experiment of thirty 18-29-years-old female participants to complete tasks by using a prototype of the stakeholders' application . All participants viewed all advertising units and were measured for their satisfaction toward the app and recall of the ads. Friedman test and Bonferroni-corrected Wilcoxon signed ranks test were used to examine significance of the ordinal satisfaction scores. Repeated measures logistic regression and Bonferroni-corrected McNemar test were used to examine the dichotomous recall data.

Research Paper

The Sweet Spot: Balancing Customer Satisfaction and Advertising Effectiveness in a Mobile App

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Abstract

Mobile advertising opened a revenue stream for app developers. However, customer satisfaction and advertising revenue may drop if the ad is not shown in a proper way. This paper studied the effect of three advertising units (banners, interstitials and integrated ads) on customer satisfaction and recall of the ads. A within-subject experiment with 30 participants showed significant effect of advertising units on both screen factor customer satisfaction and recall. Interstitials and integrated ads were found to lead to increased satisfaction when compared with banners. The customer satisfaction difference between interstitials and integrated Ads was not significant. No significant difference was found in recall during pairwise comparisons of the three advertising units. The conclusions of this study suggested stakeholders who value both customer satisfaction and ad revenue to use either interstitials or integrated ads.

Introduction

Research Question from the stakeholder: What is the effect of the size and location of inline advertisements on customer satisfaction in a picture-based social networking mobile phone app?

Adding inline advertisement is the future trend for increasing revenue. Smartphones have a growing market in the United States since users increasingly use wireless mobile device to view online content through applications. In this emerging market, it is well known that one of the most lubricative way for a company to earn revenue is putting advertisement in the application. Many companies, such as Instgram -- one of the well known photo sharing application-- started to earn revenue by posting advertisement in 2012[1]. In recent years, major photo sharing application

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[1] Facebook's Instagram Begins showing Ads to Earn Revenue

companies started to seek ways to increase revenue by inserting advertisement[23]. The outlook of adding inline advertisement to photo-based application is high, and venture capitalist are confident to invest companies who are going to take this approach. Adding inline advertisement on photo-based application is a growing trend to revenue earning.

To keep up with the trend, our stakeholder is looking to increasing revenue by adding in line advertisement in their picture based social networking mobile phone application. According to the stakeholder, this application is picture-based without much text. Their users will upload a lot of pictures without writing much description on this application. Picture viewing is the dominant function of this application, and sharing photos is another important function users usually use. This is the v1.0, and many aspects are still under development. The stakeholder mentioned that many specifications of the application are not available since the application is not released yet. Information of advertisement pricing model is unavailable. The stakeholder states that the goal is to develop an experience that provides the best mix between customer experience and ad-presentation spaces. That is, customer satisfaction is very important to the stakeholders.

The stakeholder's clients, who are interested in putting advertisements in the application, would like to target their ads toward to young female users age between 18-29. This population are the very sensitive to the intrusion of advertisement when using their application on phone. In addition, the stakeholder points out that this group of users "respond favorably to relevant advertising, when relevant and done properly". The stakeholder has software to select and show contextually relevant ads, but he expects to get some guidance of properly displayed advertisement from this research.

According to the stakeholder, the most popular phones their users use are iPhone 5 (screen size 1136-by-640 pixel) and iPhone 4 (screen size 960-by-640 pixel) and similar screen size cell phones with Android system. According to PEW research center report[4], in the year of 2013, the amount of young female iPhone users (age 18-29) is similar to the amount of cell phones with Android system in the US. In addition, iPhones and cell phones with Android system have similar screen formats[56]. However, the 2013 data shows that advertisements on social networking application bring in 1790% higher revenue on iPhone than Android[7]. Since our stakeholder aims to increase his revenue efficiently, we will focus on iPhone models rather than cell phones with Android system for this research with our limited time and budget.

Any kind of advertisement format will be considered in this research. The stakeholder points out that the company is considering using placement advertisement in their application as part of

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[2] [As Pinterest Grows, Starups Seeks %2.5 Billion Valuation](#)
[3] [Mobile Advertising Overview, Mobile Marketing Association](#)
[4] [PEW research center report. Smart phone Ownership: 2013 Update](#)

[5] Android Developers' Guide: http://developer.android.com/about/dashboards/index.html

[6] Android Developers' Guide: http://developer.android.com/guide/practices/screens_support.html
[7] [Facebook Mobile: ad Profit 1,790% Higher on iPhone vs. Android](#)

their in-line advertisement. In addition, they are considering the most common types of advertisement, the interstitial advertisement and banners as well.

Our stakeholder gave us the research question: what is the effect of size and location of inline advertisements on customer satisfaction in a picture-based social networking mobile application? After considering all aspects from the stakeholder, we boiled down questions into two critical elements. The two elements are stakeholder revenue and customer satisfaction. In this research, we will find out the optimal practice of inline advertisement that maximizes stakeholder's revenue without over-sacrificing customer satisfaction of the application in the picture-based social networking mobile application.

Background

Screen Orientation

We researched the common practice of major social networking applications (Facebook, LinkedIn, Instagram, Twitter, Pinterest, Flickr). We found that most social network mobile apps use portrait rather than landscape orientation on iPhones . All apps researched allow users to scroll up and down as their major interaction mode for users. Only one of them, Flicker, allow users to scroll left and right. We concluded that the portrait is the most commonly seen orientation for social network application on iPhones. Scrolling up and down is the most commonly seen interaction in photo-viewing and sharing practice. Hence we designed our experiment prototype with portrait orientation with upward and downward scrolling function.

Position of the advertisement

From our literature review, advertisement position and content are the two most important elements in in-image advertising system in general[8]. The study of online image advertisement determines position by using automatic face detection system to determine where the location of the ad should be in image. However, iPhone does not support this kind of advertisement, so we do not need to put other locations into consideration.

Types of advertising units on iPhone

iPhone 4 has relatively shorter screen (960 x 640 pixel) than iPhone 5 (1136 x 640 pixel). However, when developing static advertisement on these two devices, there is no differences in sizes of advertisements. Basically, there are two kinds of static advertisement: advertisement banners on the top or bottom of the application, interstitial advertisement, and the integrated advertisement which shows up when users scrawling up and down to view pictures.

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[8] Xian-Sheng Hua; Tao Mei; A Hanjalic. Image Advertising. In *Online Multimedia Advertising : Techniques and Technologies.* Hershey, PA : Information Science Reference (2011)
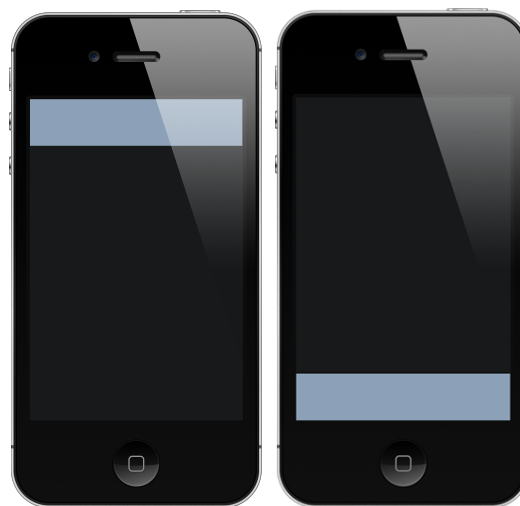
Banners

The banner advertisement can be text or image in static or animated forms, which is placed in defined areas (usually at the top or the bottom of the application) on certain pages within the application. Some banner advertisements are dynamic banner ads. Users may navigate and click on the dynamic banner advertisement to browse for more information about the product or service advertised.

According to iAd guideline published by Apple Inc, there is only one standard size of advertisement banner to display on the top or bottom of applications used on iPhones[9]. Although Mobile Media Association issued different definitions of banner sizes for iPhones-- large, medium and small sizes[10]-- these standards are not followed[11] in practice on market. The standard banner size is the only size used on iPhones.

According to iAd, the standard banner size is 320 x 50 pixel (320 pixel wide and 50 pixels height) on both iPhone 4 and iPhone 5, even though iPhone 5 has larger screen size than iPhone 4. Therefore, we only have one variable for the size of advertisement for the top or bottom display for our initial research question.

The top banner of iphone is located on the top of the screen. The location can vary depending on the type of the application. The bottom banner is located on the bottom of the screen, sometimes between the application and control buttons.

Top banner   Bottom banner

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[9] iAd Programing Guide.

[10] MMA Report

[11] Hussain, Rahim, Arthur Sweeney, and Gillian Sullivan Mort. "Typologies of banner advertisements' attributes: A content analysis." *Journal of Promotion Management* 16.1-2 (2010): 96-113.

In our previous research, we found that there is a significant difference in advertising effectiveness between the top banner and lower banner. The top banner is not as effective as the lower banner in click through rate and advertisement recall rate[12]. Therefore, we will use only the bottom banner as one of our variable for this research.

Interstitials

Interstitials are usually full-paged advertisement which show up when users are launching, loading, or exiting the application. It may contain images, texts, audio or videos. The format of interstitial advertisement can be animated or static. Some interstitial advertisement is dynamic full-page ad that the user can navigate and click the ad to access for more information about the advertisement[13].

Interstitial ad: it is usually is a full-page ad.

In the case of iPhone, the only size of the interstitial advertisement is 320 pixel wide and the maximum height as the application. There are several types of interstitial advertisements according to its difference in the duration of its appearance (exposure time) and the timing for showing up (during launching, loading, or exiting the application).

In our previous study, we found that the most effective interstitial advertisement format is the one which shows up for two seconds when the application is launching[14]. In this research, since we are going to find out the most effective advertisement for comparison, we decided to use this one as one of our independent variables.

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[12] We have to use the fabricated research result to reduce the number of our independent variables according to the course instructor's request.

[13] InMobi 2013 Q3 insight report, page 9 http://info.inmobi.com/rs/inmobi/images/InMobi_App_Insight_Report.pdf

[14] We have to use the fabricated research result to reduce the number of our independent variables according to the course instructor's request

Integrated Advertisements

The integrated advertisement, also is known as product replacement, is integrated in the application as part of the it. According to Mobile Media Association, integrated advertisement is usually formatted to be compatible with the main content of the application[15]. In a photo-based application, integrated advertisements are usually seen in a format similar to the photos users are viewing. It is usually the same size as the photo displayed in the application. Like photos that users are viewing on the application, integrated advertisements can be scrolled up and down by the users. Since there are several sizes of the photos in the photo-based application, there are several sizes of integratedl ads available to replace some photos in the application. The show-up rate can vary according to the request of the advertisers. Usually there is only one integrated ad on each screen in common practice.

Integrated advertisement: it can be scrolled up and down by the user.

Based on our previous research[16], the most effective integrated advertisement is the full-screen size one which appears every five screens to replace the full-sized photo users are browsing. The size is usually 320 pixel wide and the maximum height[17] of the various applications. We decided to use this one as our independent variable.

Advertisement Formats

Literature review indicates that the presentation of advertisement (the format) does not necessarily increase its effectiveness[18]. Advertisements in high-cost formats such as animation,

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[15] 2009 MMA mobile advertising overview

[16] We have to use the fabricated research result to reduce the number of our independent variables according to the course instructor's request

[17] Prevailing in-application advertisement formats

[18] Lee J.; Ahn J.-H. Attention to Banner Ads and Their Effectiveness: An Eye-Tracking Approach. In *International Journal of Electronic Commerce*, v17 n1 (2012 10 01): 119-137

flashy, floating movement, or blinking colors are as effective as static advertisement with only text. High cost formats do not have better results in advertising effectiveness[19]; however, studies shows that these advertisements will cause more irritation to users by distract their attention from what they want to achieve. Some users intentionally avoid looking at animated advertisement because they had negative experience with them. Moreover, high-cost formats are rarely used in iPhone advertisements because it is very difficult to engineer and the cost is extremely high.

High-cost formats advertisements are considered by users to impede their goals more than static ones[20], lower customer satisfaction by increasing annoyance without increasing its effectiveness in advertisement, and rare to be used in industry. We decided to label the formats of advertisement a control variable since literature reviews shows that there is no differences between different formats of advertisement and few companies are producing them for iPhone.

The revised research question
After our initial research, we decided to revise our research question which reflects the result that we are going to find out. Since we are mainly comparing the three advertising units mentioned above, we should reflect that in our research question.

The research question: What's the effect of advertising units on customer satisfaction and ad effectiveness on the photo-based social network mobile application?

Methods

Hypotheses
Hypothesis 1: a change in advertising units will result in a change in customer satisfaction with the screen factors of the application.
Hypothesis 2: a change in advertising units will result in a change in customer recall of the advertisement.

Variables
As mentioned in the Introduction section, the focus of this paper is to find the effect of different advertising units on customer satisfaction and advertising effectiveness. In this research question we have one nominal independent variable of three categories: banner, interstitial and integrated ad. We have two dependent variables: customer satisfaction and advertising

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[19] M Burke; A Hornof; E Nilsen; N Gorman. High-cost banner blindness: Ads increase perceived workload, hinder visual search, and are forgotten. In *ACM Transactions on Computer Human Interaction*, 12, no. 4, (2005): 423-445
[20] Chang-Hoan Cho Why Do People Avoid Advertising on the Internet? In *Journal of Advertising,* v33 n4 (Winter 2004): 89-97

effectiveness. As stated in the Introduction section, the format and content of ads are our control variables.

Measurements

QUIS for measuring customer satisfaction

Customer satisfaction was measured using part of the Questionnaire for User Interaction Satisfaction (QUIS)[21]. QUIS will evaluate application satisfaction in 9 points Likert scale in 41 questions. QUIS is still effective if the researcher uses only one section[22]. Because the photo-based social network application is still at its early development stage, we developed an application prototype with limited interaction according to the stakeholder's application models. Some QUIS questions, such as questions about the whole application system, are not applicable to evaluate the prototype because the prototype has limited function.Therefore, we only used the most relevant section -- the Screen Factor section of QUIS -- to measure customer satisfaction. We quantified customer satisfaction about the screen factors to a 1-9 scale. Note that because we used a section of QUIS the customer satisfaction scores that appear in this study should not be compared with the standardized QUIS scores in other studies.

Measuring advertising effectiveness

Advertising effectiveness was measured by customer recall rate of the advertisement. At the end of our experiment we asked users whether they remember seeing any advertisement in the prototypes they used and what they remember from the advertisement. There are simply two answers: either "yes" or "no" for each advertisement. If a participant recalled the correct product name or company name from an advertisement, we recorded a "yes" for that advertisement. If, however, the participant didn't recall any brand name or recalled a wrong information, we record a "no" for that advertisement meaning that although the advertisement appeared on the participant's screen it was forgotten at the time our experiment ended.

Readers might have doubt why we measured advertising effectiveness by recall. The reason comes in three folds. First, unlike customer satisfaction which can be measured by standardized questionnaires, there is little consensus about how to measure advertising effectiveness in either industry or academia[23]. Although there are many research models[24] and techniques (e.g. eye tracking, click-through rate) available, there is no standardized method to measure to evaluate advertising effectiveness to the best of our knowledge. Second, asking participants to answer recall questions are commonly seen in literature to measure short-term

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[21] Chin, John P., Virginia A. Diehl, and Kent L. Norman. "Development of an instrument measuring user satisfaction of the human-computer interface."*Proceedings of the SIGCHI conference on Human factors in computing systems*. ACM, 1988.

[22] QUIS Official Site: http://www.lap.umd.edu/QUIS/index.html

[23] Wells, William D., ed. *Measuring advertising effectiveness*. Routledge, 1997.

[24] Lavidge, Robert J., and Gary A. Steiner. "A model for predictive measurements of advertising effectiveness." *The Journal of Marketing* (1961): 59-62.

impression[25]. In our experiment we primarily concern about if the advertisement that appeared on the screen caught the participants' attention. In addition, if the advertisement impressed users. A recall test in the end of our experiment will answer these questions. Third, using recall questions as measurement will avoid creating practical issues in our experiment. For example, eye tracking as the measurement will create such issue. While eye tracking elicits valuable data about where a user is looking at on a screen in most cases, it is not as useful when evaluating interstitials as for banners and integrated ads. In the interstitials trials, the ad will take up the entire screen. In this case, the user do not have full control over looking at the ad versus the content (if s/he looks at the screen at all). Moreover, the time that is spent on looking at an ad is not fully controlled by the user either -- it is determined by the ad exposure time, the parameter which determines how long an interstitial can stay on the screen. We could not use click-through rate to measure ad effectiveness because our experiment was carried out in the lab with very short period of time, which is not a good condition to measure click-through rate. After considering a myriad of methods, we select recall questions as the most appropriate measurement for measuring advertising effectiveness.

Participants

Our recruiter recruited 30 female participants, age between 18-29 with an average age of 24. They all resided around the greater Seattle area. All participants have used smartphones for at least 2 years before the experiment. Two-third of them had at least one social networking app installed in their smartphones. Before the experiment, 12 participants only had experience using iPhone, and the 12 only had experience using cell phones with Android system, 4 had used both iPhone and phones with Android system, and 2 had used other smartphone operating systems. One-third of our participants were students.

Prototypes

We developed three prototypes for the participants to test in the experiment. The three prototypes were similar in all aspects (e.g. appearance, content, interaction design and information structure) except advertising unit. The first prototype (we will call it the banner prototype for the rest of this paper) used a 320 x 50 bottom banner that contained a single static image. The second prototype (we will call it interstitial prototype) used a full-screen interstitial ad whose exposure time was two seconds. The third prototype (we will call it integrated ad prototype) used an integrated ad that was presented in the same way as app contents, which were pictures in our case.

We prepared a pool of 15 photos and 3 ads for the three prototypes. These photos were sample content from our stakeholder. These photos varied in sizes and aspect ratios. The three ads were from three of our stakeholder's contract advertisers (their clients). The three ads featured

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[25] M Burke; A Hornof; E Nilsen; N Gorman. High-cost banner blindness: Ads increase perceived workload, hinder visual search, and are forgotten. In *ACM Transactions on Computer Human Interaction*, 12, no. 4, (2005): 423-445

food, dress and makeup, all of which passed our test of content relevance[26] using stakeholder's software. Each ad had three size variations so that their product can be shown in our three advertising units. Despite the various sizes, all 9 variations of advertisements share similar design: all of them featured a photorealistic picture of their product which takes up more than half of the advertisement area and all of them used bold text to call out the brand name in the advertisement.

Each prototype would only show five photos and one advertisement on each launch. The computer software randomly chose photo content and the type of advertisement to show to different participant. If a photo or a type of advertisement had already been shown to a participant, it would not be shown again to the same person. Therefore, by the end of the experiment, all participants had seen all fifteen photos and three types of advertisements.

Other design aspects of the prototypes followed the stakeholder's design and common industry practices[27]. All pictures shown in the app were resized so that their width equaled screen width. The prototypes preserved the aspect ratios of the original pictures when resizing them. The only exception was when a photo's height exceeded screen height after resizing, which happened because the photo was too long and when displayed vertically. In this case part of the photo was omitted and users had to tap on an expand arrow to see the full image. All pictures were followed by a brief text description, a "like" button and a "comment" button that a user can click. The app logo and a few buttons (e.g. "likes") were shown in a menu bar that persisted on top of the screen. The fundamental interactions within the app was scrolling up and down and clicking on buttons. Because the prototypes pulled contents from a fixed-sized pool, the participants could not scroll infinitely as they could in a real application. These photos in the prototype were not clickable; however, the banner, interstitial and integrated ad were clickable. If a user clicked on an ad, the prototype would lead them to the ad sponsor's website.

Experiment

We designed a within-subjects experiment for our 30 participants. Before the experiment began all participants were informed that:
(1) The purpose of the study was to research customer satisfaction and advertisement design.
(2) The experiment contained four sessions and would take no longer than an hour to finish. Each session should last approximately fifteen minutes but participants could take breaks at any point during the experiment. In each of the first three sessions they would use a prototype for about five minutes and then answer a set of questions about how satisfied they are with the prototype. We did not disclose details of the last session because doing so would affect the measurement result. However, participants could leave at any time if they do not wish to continue the experiment.

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[26] It was known to the stakeholders before this study that the content of an advertisement must be relevant to other contents on the screen to avoid annoying users. The stakeholder had software to judge the relevance of an advertisement to the app content.
[27] Whenever a design specification was not clear from our stakeholders, we adopted designs used by popular picture based social networking apps such as Instagram, Pinterest and Flickr.

(3) The prototype was at its early development stage and was not developed by the researchers. All participants gave their consent for us to use their data produced by the experiment.

The experiment process

In the first three sessions of the experiment all participants tried all three prototypes in a randomized order. For each prototype, the participants were asked to like one of the five photos in the prototype and then find that photo in their "likes" folder. The integrated ad could be liked just like the content photos but the banner and interstitial advertisements could not be liked. After participants completed the tasks for a prototype, they were immediately presented with our customer satisfaction questionnaire. We asked participants whether they would like to take a break before proceeding to the next session.

The last session of our experiment was a recall test. As described in the Measurements section, the participants' task in this session was to recall any advertisement they had seen in the previous sessions. The participants were not informed of this task until they have finished the first three sessions. We decided to put the recall test at the end of the experiment because we believed that asking users to recall after a session ended would cause the user to pay more attention to advertisements in the next session, leading to inflated recall rates. We also noted the drawback of performing the recall test in the end: participants may forgot ads shown earlier than Ads shown later. However, because the time span of our experiment was relatively short and because we randomized the order for ads to show up, we argue that the benefits of doing the recall test in the end outweighs its drawbacks.

Results and Analysis

Customer Satisfaction

We first examined normality of the dependant variable. Shapiro-Wilk test showed that customer satisfaction for the banner trials ($p<0.05$), the interstitial trials ($p<0.05$) and the integrated advertisement trials ($p<0.05$) all significantly deviated from normal distribution. Such result was reasonable since we measured customer satisfaction with a 1-9 ordinal score.

Because our DV data violated the normality assumption of one-way repeated measures ANOVA, we used Friedman test which is a non-parametric alternative to repeated measures ANOVA but does not assume data normality. Friedman test showed that the effect of advertising units on customer satisfaction with the screen factors was statistically significant (chi-square(2)=35.676, p<0.05), supporting Hypothesis 1.

To further examine the differences occurred between the IV pairs, we performed Wilcoxon signed-rank tests on Banner-Interstitial, Banner-Integrated and Interstitial-Integrated pairs. Note that since we were doing multiple comparisons we needed to use a Bonferroni adjustment on the results of the Wilcoxon test. In our case, since we were using 0.05 significance level and we were comparing three pairs, we needed to divide our significance level by three: 0.05/3=0.017. This means that if the p value of the Wilcoxon test was larger than 0.017 we did not have a statistically significant result.

Results of Wilcoxon signed-rank tests showed that customer satisfaction on screen factors was significantly lower in the banner trials than in the interstitial trials (Z=-4.597, p<0.017) and the integrated ad trials (Z=-4.104, p<0.017). There was no statistical difference in customer satisfaction on screen factors between the interstitial trials and the integrated ad trials (Z=-1.860, p>0.017). This result implied that if stakeholders were to choose an advertising unit using a single criteria of increasing customer satisfaction with screen factors, both interstitials and integrated Ads are better choices than banner Ads. Moreover, both interstitials and integrated Ads were better for customer satisfaction with screen factors than banner Ads. There was no significant difference between interstitials and integrated Ads.

Recall rate

The recall DV was a dichotomous variable ("yes" / "no") which violated data assumptions of both repeated measures ANOVA and Friedman test. Therefore we used repeated measures logistic regression to examine the effect of advertising units on participant recall of the advertisements. The result of the test showed a statistically significant effect of advertising units on participant recall (Wald chi-square(2)=7.409, p<0.05), and it supported Hypothesis 2.

We further examined pairwise differences occurred between the three IV trials. Because the dependant variable was dichotomous we used McNemar test for the pairwise comparison. Similar to the pairwise analysis in the previous section, we used a Bonferroni adjustment on the results produced by McNemar tests, resulting to a significance level set at p<0.017.

Results of McNemar tests showed no statistical significance on participant post hoc recall between the banner trials and the interstitial trials (p>0.017), nor between the banner trials and the integrated ad trials (p>0.017), nor between the interstitial trials and the integrated ad trials (p>0.017). This implied that if stakeholders were to choose an advertising unit based on the sole

criteria of customer recall rate, banners, interstitials and integrated ads were equally good (bad) options.

Recommendations and Conclusions

In this study we examined the effect of advertising units (banner, interstitial and integrated ads) on customer satisfaction and advertising effectiveness (customer recall rate) of the advertisements in a picture-based social networking application. Statistic tests showed that the effect of advertising units was significant on both satisfaction and recall. Pairwise comparisons of experiment trials revealed that both interstitials and integrated ads lead to increased customer satisfaction, which was statistically significant. The comparisons did not show any significant difference between interstitials and integrated ads on customer satisfaction. Nor did the comparisons shown any significant difference in recall among the three advertising units.

Based on these findings, we provided recommendations to stakeholders following the dual-criteria of maximizing advertising effectiveness (measured by recall) without sacrificing satisfaction (screen factors). Here are our recommendations:

1. Interstitials and integrated ads are better than banners. These two units had higher customer satisfaction and had similar amount of recall as banners did in our experiment.

2. We do not have preference between interstitials and integrated advertisement. There is no significant difference between interstitials and integrated advertisements in customer satisfaction and advertising effectiveness. In our experiment of satisfaction and recall, no evidence suggested either unit was better than the other.

Discussions and Future Work

There are several limitations in this study that we would like to address in the future.

First, we did not study the effect of combinations of advertising units in an application on customer satisfaction and advertising effectiveness. Industry guidelines[28] suggested that interstitials could be combined with other advertising units in an application. It is possible that proper combinations of advertising units can improve advertising effectiveness without lowering satisfaction. We hope to investigate this aspect and address it in the future.

Second, our experiment was performed by using iPhone4s. Caution is needed when generalizing our results to other smartphones. For future study we hope to repeat the same experiment procedure on other smartphone models to improve the generalizability of our conclusions. We also expect different findings on other phone models. We especially hope to

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[28] 2009 MMA mobile advertising overview

perform our experiment on phones with Android systems owing to its large user population[29]. Moreover, the research shows that interstitials are much more effective than other advertising units on Android[30] systems but this finding does not apply on iOS.

Other limitation we hope to address and possible research in the future:

The prototypes were not final products. We expected that there would be some difference between the prototype and the real application.

The recall test measured in our experiment was only a part (attention and impression) of advertising effectiveness. The finding could be more complete if we have time and resources to add other measurements in combination with the recall measurement.

Our measurement of customer satisfaction was only concerned about customer satisfaction with the screen factors of the app. It is not equivalent to the general QUIS score. However, as mentioned before, we have to use the functionable application to complete QUIS evaluation, which was not available when we carried out our experiment. We hope to carried out the complete QUIS evaluation in the future.

Acknowledgements

References

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[29] Mobile Statistics 2013
[30] App Insigt Report 2013