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# Gesture Ads for Mobile Applications

Bachelor Thesis (6 EAP)

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# Abstract

Mobile advertising is an inseparable part in today's mobile application development. In many cases advertising enables the developer to offer their application to users for free. However, more often than not, in-application advertisements prove to be distracting to the user and, in extreme cases, even degrade the user experience to a point where the user decides to stop using the application. In any case, the user most often tends to just ignore the advertisements, which makes the advertising model ineffective and compromises the reputation of the application without significant gain for any party.

The goal of this project is to develop a library that application developers can use, which would integrate advertisements more seamlessly into the flow of the application. It would allow the application to receive all the necessary data via a push notification from the server and then display a very minimalist form of it to the user, without taking up too much of the very limited screen space of the device. The application will then hopefully still retain usability for any time-critical activities.

The user can focus his/her attention on the advertisement when the time is most suitable (e.g. they have finished reading a paragraph). The user can then use a spread motion to view more a detailed description of the advertisement or flick it either left to show disinterest or right to show interest  a motion many mobile users are already conceptually familiar with. Data will then be sent back to the server to be processed and, based on the processed data, the future advertisements can be more suited to the user's interests. Showing interest in the advertisement will also store it for future viewing, should the user wish to do so. If the user chooses to ignore the

advertisement, it will remain on the screen for a period of time and then disappear.

Another use case would be to incorporate the user's current location to the process. This would allow the user to receive advertisements not only relevant in terms of their interests, but also in terms of their current location.

By the end, the library will hopefully serve three purposes:

- It will make the application more enjoyable for the user, by offering less intrusive methods of advertising and advertisements more relevant to the individual user.
- It will make incorporating mobile advertisements easier for the developer and give the developer more freedom to focus on user experience, without having to worry about advertising mechanics.
- It will allow the advertiser to offer content relevant to the user, thereby increasing the user's perception of the product as well as the likelihood of the user choosing to learn more about the offer.

# Contents

# 1

# Introduction

Mobile advertising is an inseparable part in today's mobile application development. In many cases advertising enables the developer to offer their application to users for free. The most common way advertisements are displayed to the user is taking up a big part, if not all, of the device's screen real estate giving the developer little control of the content of the advertisements; often tricking users into clicking the link within the advertisement instead of closing it.

## 1.1 Motivation

More often than not, in-application advertisements prove to be distracting to the user and, in extreme cases, even degrade the user experience to a point where the user decides to stop using the application. In addition, usually the user tends to just ignore the advertisements. This makes the advertising model ineffective and compromises the reputation of the application, as well as the developer, without significant gain for any party.

Advertisements influence people's attitude towards advertising by a great deal. When advertisements employ techniques that irritate or bother the user, then the user is likely to perceive them as an unwanted influence.(1) A less intrusive and more intuitive, user feedback based method of displaying advertisements would improve the user experience of the application with the added benefit of users being more likely to see the content of the advertisement.

## 1.2 Contributions

The goal of this thesis is to describe current advertisement models for mobile applications and explore new mechanisms to deliver ads, which are not as intrusive as current solutions.

As a result, a new mechanism, namely *Gesture ads*, will be designed and implemented. This mechanism will display advertisements in a way that is less distracting for the user and has less noticeable of an impact on using the application. It will also give the user a chance to give honest feedback on advertisement topics they like and dislike, which allows providing the user with more relevant advertising without relying on profiling algorithms.

The objectives of the new mechanism are the following:

- To make the application more enjoyable for the user, by offering less intrusive advertising and advertisements more relevant to the individual user.
- To ease the integration of mobile advertisements into the applications and give the developer more freedom to focus on user experience, without having to worry about advertising mechanics.
- To enable the advertiser to offer content relevant to the user, thereby increasing the user's perception of the product as well as the likelihood of the user choosing to learn more about the offer.

To distribute the mechanisms, a Java library for Android (2), was be created. Application developers can use the library, which would integrate advertisements more seamlessly into the flow of the application. It would allow the application to receive all the necessary data via a push notification from the server and then display a very minimalist form of it to the user, without taking up too much of the very limited screen space of the device. The application should still retain usability for any time-critical activities with the advertisement being movable if necessary.

The user can focus their attention on the advertisement when the time is most suitable. They can then use a spread gesture to view a more detailed description of the advertisement or flick it either left to show disinterest or right to show interest. Data will then be sent back to the server to be processed and stored. The server application

can then take into account, among other things, the user's preferred topics and location to send advertisements more relevant to the user.

Showing interest in the advertisement will also store it for future viewing, should the user wish to do so. If the user chooses to ignore the advertisement, it will remain on the screen for a period of time and then disappear.

The new mechanism was evaluated and compared to classical mobile advertising based on the opinions of a set of 25 people. According the the results, the proposed mechanism is more effective than classical methods of advertising. It is more user-friendly, less intrusive and draws more attention to the advertisement from the user.

## 1.3 Outline

**Chapter 2**: describes the most popular mobile advertising frameworks used today and discusses the pros and cons of each. It also takes a closer look at some of the more unorthodox advertising frameworks that do not follow the most common patterns of mobile advertising and take user experience regarding mobile advertisements to the next level.

**Chapter 3**: describes in detail the development process and the final proposed mechanism. The developed font-end library as well as the server application used to test the library.

**Chapter 4**: takes a closer look at user feedback regarding the advertising method as well as mobile advertisements in general. Brief analysis of the results.

# 2

# Problem Statement

The most classical methods of displaying advertisements inside mobile applications are either as a banner or as a full-screen interstitial as seen on Figure 1.

A banner advertisement is static and throughout the usage of an application takes up screen space that could otherwise host content of the application itself. In addition, banner advertisements are often flashing or making sound, further distracting the user from using the application.

Interstitial advertisements pop up from time to time throughout the usage of an application and temporarily stops the user from using the application altogether. Full-screen advertisements can be closed but it is often not intuitive how to do so without tapping on the advertisement itself and being redirected to the advertiser's website. In addition, opening and closing an interstitial advertisement often takes too long. it distracts the user and might get them out of the mood of using the application.

## 2.1 Research Question

The proposed solution for the problems that classical advertising methods have, is to display advertisements to the user in a way that the user could choose the location and size of the advertisement on the screen. This thesis tries to figure out whether this sort of mechanism is more user-friendly than mechanisms currently in use.

To do so, such a mechanism is developed and implemented for a mobile application as a proof of concept. People are then asked to compare it to classical mobile advertising in terms of intrusiveness and their interest in the advertised product.


**Figure 2.1:** Examples of advertisements (3) (4)

Advertisements are an inseparable part of mobile applications, but, as it stands, they are doing more harm than good. Users should feel that advertisements are a part of an application rather than an unwelcome addition. If an application is usable without noticeable interruptions then the user can choose the pace at which they use the application and might pay more attention to the advertisements, since they can choose the time to do so.

## 2.2 Summary

This thesis tries to find a solution to many problems that classical advertising mechanisms have. To counter the problems, a mechanism is developed that would allow displaying advertisements to the user in way that allows the user to choose the location and size of the advertisement on-screen. It is then implemented into a mobile application and users are asked to compare it to classical advertising methods, to determine whether the proposed method makes the application better to use.

# 3

# Background

## 3.1 Classical Advertising Frameworks

According to a 2012 article by Matt Marshall, the most reliable companies in mobile advertising, that directly offer a monetization service for the mobile platform, are AdMob, Millennial Media, iAd, Flurry, InMobi, Chartboost, MoPub and Amobee. (5) Following is a short overview of these eight platforms.

AdMob was founded in 2006 and acquired by Google in 2010. (6) According to research firm eMarketer Google is, by a large margin, the leader of the global digital ad market. (7) At the time of Google acquiring AdMob it was one of the market leaders in mobile advertising. (8) In 2011 it was merged with their existing AdSense platform, which is a solution for web advertising. (9) AdSense has software development kits (SDKs) for Android, iOS and Windows Phone (10) and supports displaying in-app advertisements as a rectangle, a banner (11) or a full screen interstitial.(12)

Millennial Media was founded in 2006. (13) Apart from Google, it is the only other mobile advertising company in the eMarketer list of top ten global digital advertising companies. (7) They offer an end-to-end technology stack with SDKs for Android, iOS, BlackBerry and Symbian. (14) Ads can be displayed as a rectangle, banner or interstitial. (15)

Like Google, in 2010 Apple acquired a mobile advertising company – Quattro, founded in 2006. (16) It was then rebranded as iAd (17), which has not seen much success to date and, according to an article posted on Forbes, only accounts for 2.5% of mobile advertising revenues in the United States. (18) iAd only supports iOS and

the advertisements are native, meaning that the developer can define the bounds of the advertisement with x and y coordinates, width and height. (19)

Flurry was founded in 2005 and acquired by Yahoo in July of 2014. (20) The main selling point of Flurry is its analytics tool with the largest data-set on application usage. (21) Flurry supports Android and iOS and the advertisements can be displayed as either a banner or full screen.

InMobi was founded in 2007. (22) They claim to be the first advertising platform with 1 billion unique users. (23) InMobi supports Android, iOS and Windows Phone (24) and the advertisements can be displayed as a banner, full screen or native. (25)

Chartboost was founded in 2011. (26) It is a mobile games-only advertisement network and focuses on cross promotion of mobile games, meaning that most of the advertisements are about downloading other games. According to their own words it only takes ten lines of code to integrate Chartboost into an application. (27) It supports Android and iOS and the advertisements can only be displayed full screen.(28)

MoPub was founded in 2010 and acquired by Twitter in 2013. (29) Their main selling point is a large real-time bidding exchange for in-application advertisements. This means that there is no sales person between the advertiser and the developer. Advertisers bid directly for the opportunity to have their advertisements displayed in an application and developers have control and transparency over the ads that are delivered into the application. (30) Supported platforms are Android and iOS. (31) Supported formats are banner, full screen and native.

Amobee was founded in 2005 and acquired by SingTel in 2012. (32) They have SDKs for Android, iOS, Windows Phone and BlackBerry. Possible formats are banners and full screen video.

Common for all these advertising platforms is the fact that none of them offer a format where the user can interact with the advertisement apart from tapping on it and, in case of full screen ads, close it. That is not to say that attempts havent been made to make advertisements interactable and/or more fun for the user.

## 3.2 Dynamic Advertising Frameworks

In 2009 apparel maker Dockers San Francisco launched an advertisement for iPhone, which used the phones accelerometer to respond to the user shaking their phone, which

would then make a dancer, appearing on the screen, perform his moves. Dockers themselves believe that it was the first motion sensitive mobile advertisement. It was featured in iPhone games iBasketball, iGolf and iBowl.(33)

Since then many advertisers have taken to offering advertisements using the phones sensors to make them more interesting to the user. Most notable perhaps is Adtile, which uses advertisements built with standard web technologies, using a JavaScript Motion Framework which gives access, among other things, to the devices sensors and GPS, to make their advertisements fully interactable. Adtile supports Android and iOS devices. (34)

But sometimes, even though the advertisements are interesting, the user just wants to continue using the application they were using with minimal interruption by displayed advertisements. An article titled Can In-App Ads be Less Annoying for Smartphone Users? by Huber Flores, Pan Hui and Yong Li proposes a framework that would split advertisements into smaller pieces and embed them into 2D objects, such as obstacles or collectable items, in a level of a mobile game. The advertisement would then be displayed to the user over a period of time, without taking away any extra screen real estate. (35)

## 3.3 Related Works

## 3.4 Summary

As it stands, there are no well known, easy to implement libraries to display responsive advertisements in classical mobile applications. Next section describes the proposed solution in detail.

# 4

# Implementation

(An overview figure of the system is missing)

To demonstrate the feasibility of our proposed approach, we develop a Java library for Android. It consists of two parts, one in the client and the other in the server.

## 4.1 Smartphone app library

The library is a lightweight API that consists mainly of two parts: communication with the server, and the ad view. The components of the server communication part are as follows:

*AdContentLoader* is the only class that the application developer should ever have the need to call. An instance of it is initialised in an activity's *onCreate* method. It then adds the ad view to the activity's content view, registers a broadcast receiver to receive messages from the server and registers the device to Google Cloud Messaging service (GCM).(36) The application developer should also call *onPause* and *destroy* methods in the activity's corresponding methods, the first of which unregisters from GCM and the second unregisters the broadcast receiver and disposes the GCM connection. The developer can also set the position of the appearing advertisement through this class.

*GCMIntentService* is a subclass of *GCMBaseIntentService* and responsible for handling communication from GCM. *onRegistered* method is called when the device is registered to GCM and makes a call to register to our back-end with the registration id from GCM. *onUnregistered* unregisters the device from our back-end once it was unregistered from GCM. *onMessage* receives and decodes the information about an

advertisement that was sent from the server. There are also methods for receiving and handling server-side errors.

The *ServerUtilities* class is an abstraction layer for communicating with our server. It has methods for registering and unregistering the device that are called in *GCMIntentService* as discussed previously.

Finally, *FileDownloader* is responsible for downloading the image files for an advertisement once *GCMIntentService* receives and decodes them.

The user interface portion of the library is in a single class: *DynamicAdView*. It is responsible for the displaying the advertisement as well as handling the user's gestures. The view is invisible until *FileDownloader* notifies *AdContentLoader* that images for an advertisement have been downloaded. *AdContentLoader* then prompts the view to update itself with the new images. The view is then capable of handling pan, zoom and flick gestures. When the user moves the view out of the screen's bounds it remains invisible until another update notification.

## 4.2 Back-end distributor

On the server-side there is a Java server application that handles the client's requests. The main components of the application are as follows:

*Datastore* is a simple implementation of a data store using standard Java collections. It is not persistent throughout redeploys, but its only purpose is to store the ids of registered devices.

*RegisterServlet* takes as a parameter the registration id from GCM and adds it to *Datastore*'s id list. Likewise, *UnregisterServlet* takes as a parameter the registration id from that a device is registered with and removes it from *Datastore*'s id list.

*HomeServlet* is the only servlet with a graphical user interface. It has a label displaying the amount of registered devices as well as buttons to send pre-determined advertisements to the registered devices.

*SendAllMessagesServlet* is responsible for sending a push notification to each of the registered devices once a button in *HomeServlet* is pressed. It takes as a parameter the id of an advertisement and based on that builds a GCM message which it then sends to the devices, tracking whether sending the message was successful or not and then returning to *HomeServlet*

## 4.3 Summary

As can be seen, the implementation is really minimalistic. However the library can be added to any Android application written in Java and the simple back-end application can be used to demonstrate the proposed method of displaying advertisements to a mobile user.

The next paragraph discusses the method used for gathering user feedback and analyses the results.

# 5

# Case Studies

- Screenshots of the app are missing. As far as I remember there should be screenshots of traditional ads and screenshots with gesture ads, both from the same wikipedia app, am I right? - It has to be described how to introduce the library in the development process... so, you can put here the snippets you put in the README.md of the repository - I included a folder called files. Inside there is a diagram template. Try to use it for your diagrams. You just have to install GNUPLOT and then from console, ¿ gnuplot times2.plot

An application's user is generally not happy about seeing advertisements in the application. They degrade the overall experience and distract from the contents of the application itself. However, for some developers, advertisements are the only way to monetize their application.

In this chapter we try to determine how the proposed advertising methods compares to the more traditional ones in terms of user experience.

## 5.1 Setup and Methodology

To test the hypothesis, the library was implemented to an open-source Android application for reading Wikipedia articles. It is a good example of the possible use cases of the library, because most of the screen space is covered with content and more traditional advertising methods with a static location can bother and distract the user.

To measure how users view the proposed method, a questionnaire was composed. [Appendix A] It consists of 14 questions. 10 of the questions are about day-to-day

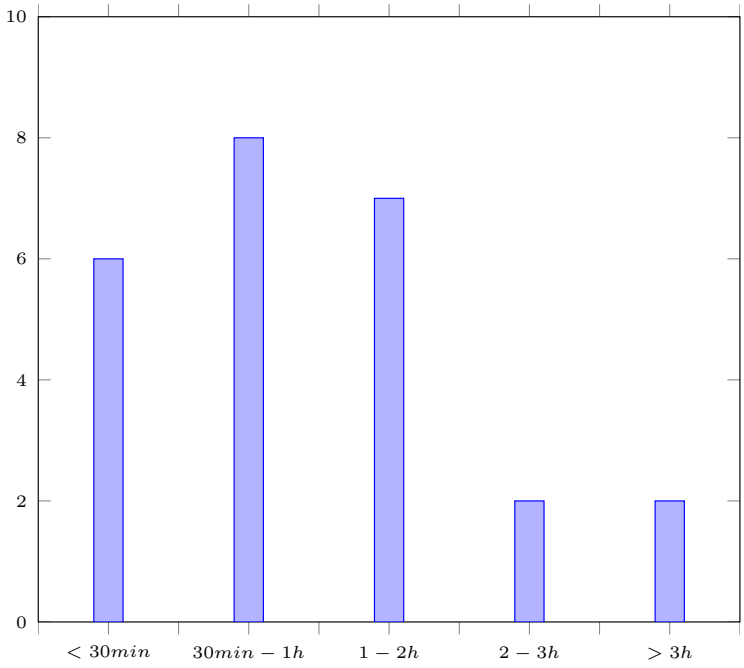


**Figure 5.1:** Participants' mobile device usage

application usage and opinion on traditional mobile advertisements. The final four questions are pertaining to the dynamic nature of the advertisement and how it compares to advertisements the participants are used to seeing in applications.

There were 25 participants between the ages of 20 and 35, all day-to-day smartphone users. 64% of the participants were male.

They were asked to answer the first ten questions. Then they were asked to read an article of their choice from the Wikipedia application, half way though which an advertisement appeared, and asked to answer the final four questions.

## 5.2 Participants' Opinion on Traditional Mobile Advertising

The participants claimed to be using their mobile devices anywhere between less than 30 minutes and more than 3 hours, however more than half of the participants use their mobile device 30 minutes to 1 hour each day as seen on Figure 5.1.

The average rating the participants gave to the amount of mobile advertisements

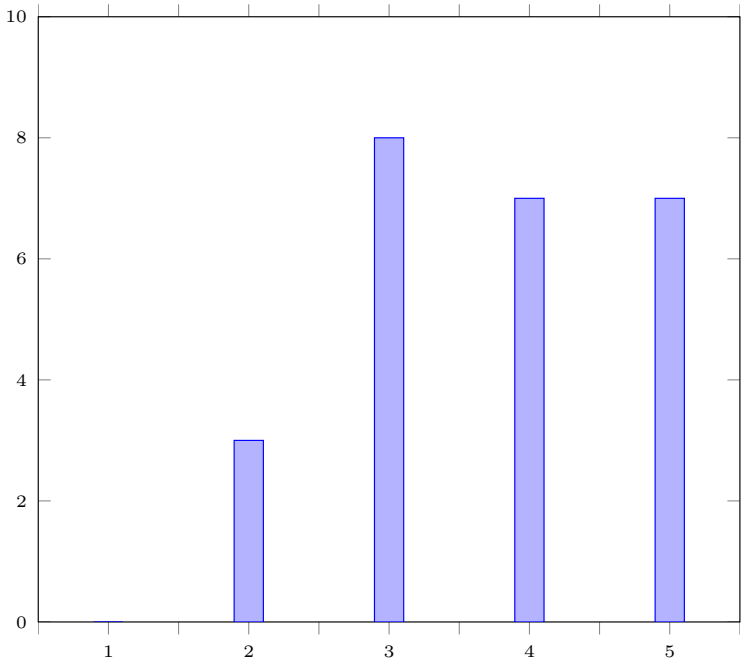


**Figure 5.2:** How much participants are bothered by advertisements in mobile applications

bothering them is 3.72 on a scale from 1 to 5, 1 meaning not at all and 5 meaning very much. None of the participants claimed that mobile advertisements did not bother them at all as seen on Figure 5.2. Many reasons were pointed out why advertisements are bothersome. The main ones being that the advertisements are distracting from using the application (flashing, sounds), take up a lot of screen space and are sometimes difficult or even impossible to get rid of.

Furthermore, 84% of the participants claim to have uninstalled a mobile application just because of the intrusiveness of it's advertisements as seen on Figure 5.3, while only 28% claim to have looked up a product or service because of an advertisement in an application as seen on Figure 5.4 and only 8% to have actually paid for a product or service they saw in an advertisement as seen on Figure 5.5.

This shows how ineffective traditional advertising methods are and that people are quite easily willing to stop using an application that has intrusive adverts. Traditional advertising methods are often quantity-over-quality and developers can easily damage their reputation without significant gain.

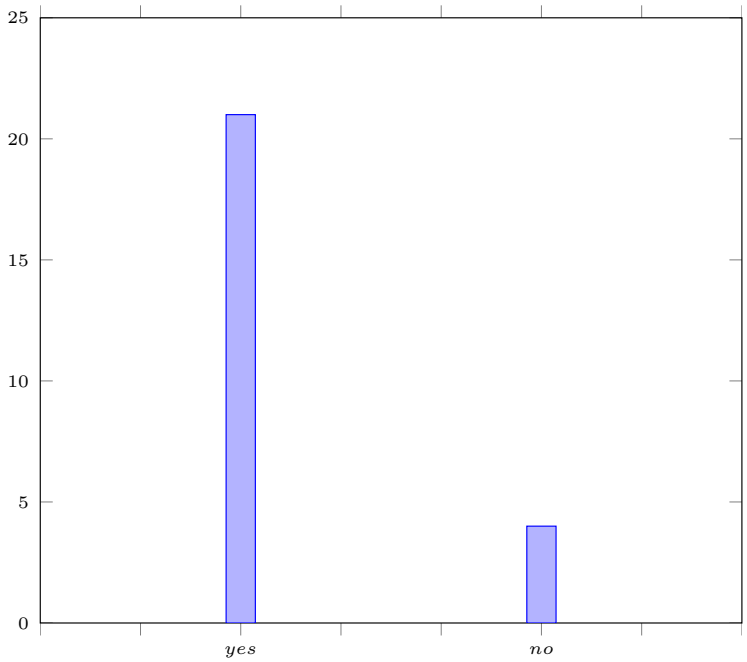


**Figure 5.3:** How many participants have uninstalled an application because of intrusive advertisements

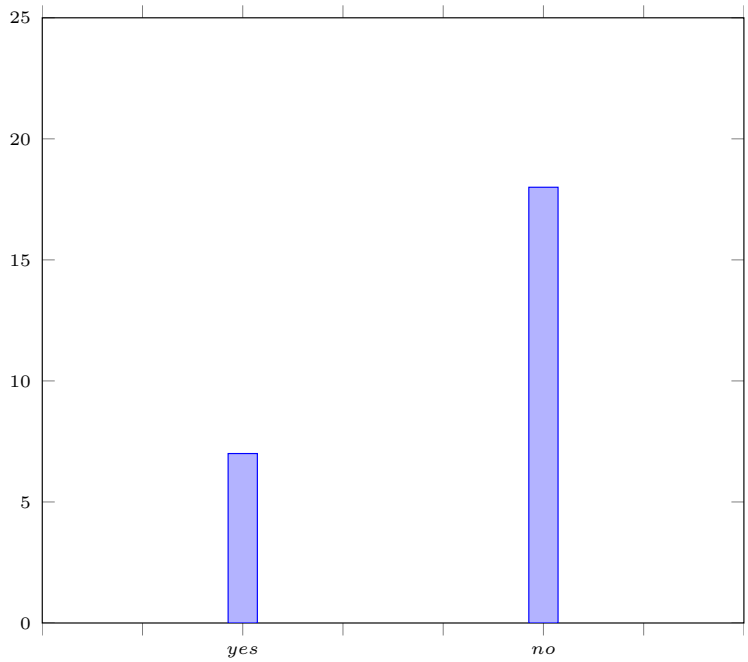


**Figure 5.4:** How many participants have looked up a product or a service because of a mobile advertisement

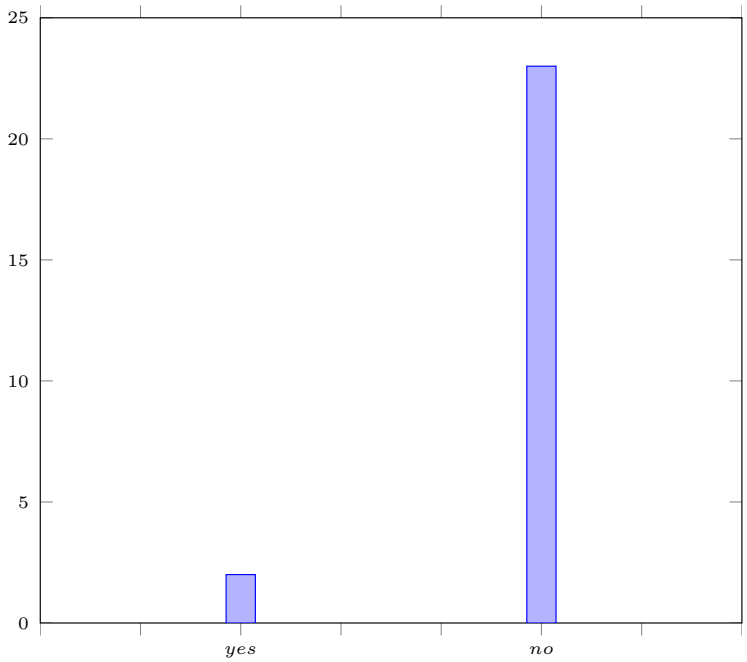


**Figure 5.5:** How many participants have paid for a product or a service because of a mobile advertisement

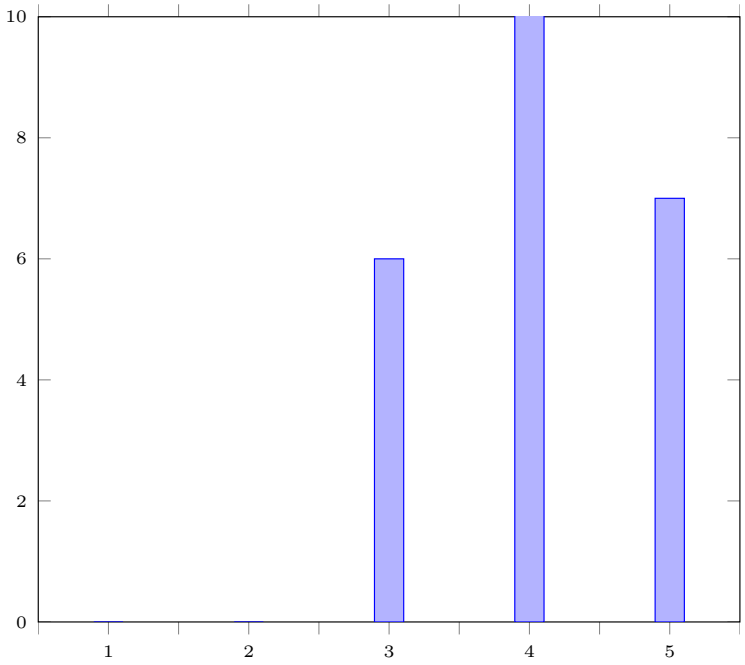


**Figure 5.6:** How likely participants would move an advertisement for later viewing

## 5.3 Participants' Willingness to Adapt to New Methods of Advertising

The participants were also asked questions about their willingness to use functionality that this library provides without having used it before, to see whether they would be willing to adapt to dynamic advertisements in the applications they use.

All the participants thought they would get rid of an advertisement as soon as it appeared at least half the time as seen on Figure 5.6, but 44% of participants thought they would move an advertisement for later viewing at least some of the times and 24% that they would want to view an advertisement later about half the times as seen on Figure 5.7.

When asked how they themselves think advertisements should be displayed in applications to make them less disruptive, the most common answers were that the advertisements should be smaller, blend in with the surroundings more and not be on top of content.

As seen from this feedback, the users would, at least some of the time, be willing

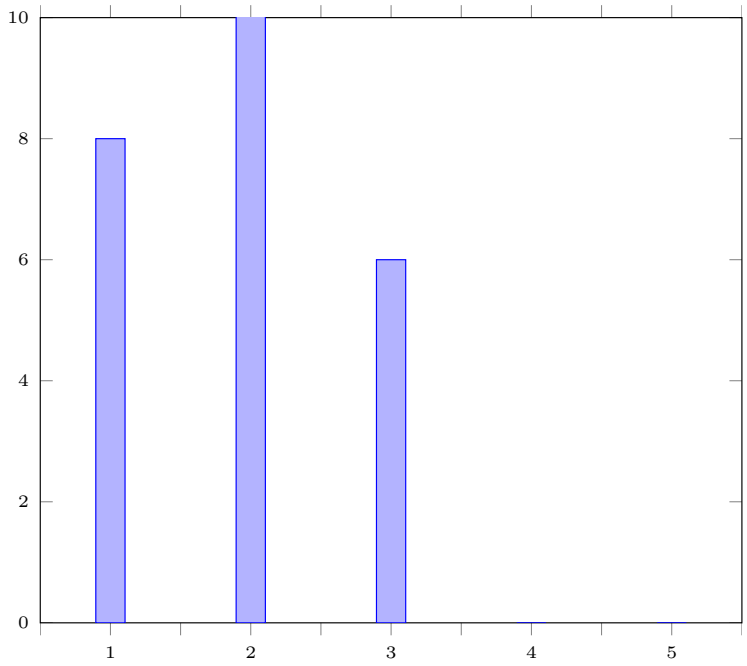


**Figure 5.7:** How likely participants would get rid of an advertisement as soon as it appeared

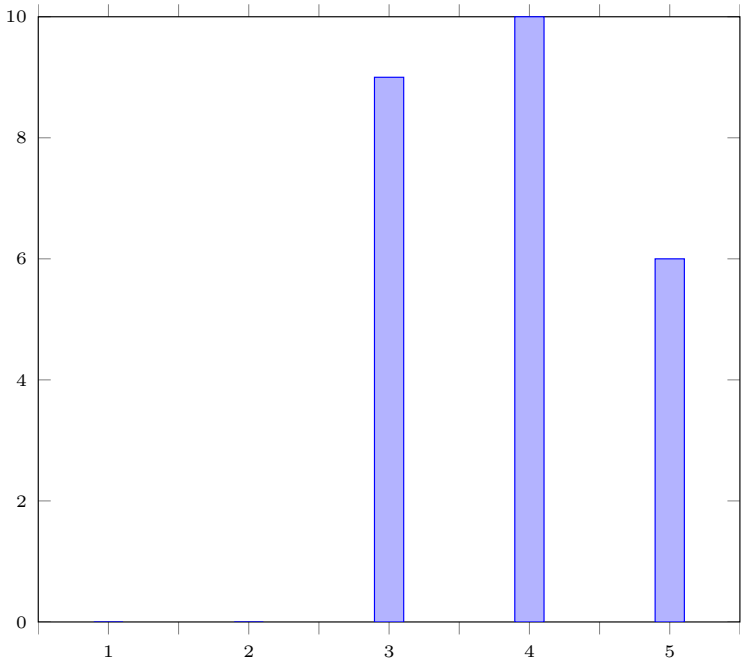


**Figure 5.8:** Intrusiveness comparison

to use the functionality this library provides for advertisements. Also, it has many of the features the users themselves proposed for making adverts more user friendly, like being smaller and not being on top of content the users wishes to interact with.

## 5.4 Participants' Opinion of Dynamic Advertisements

In terms of intrusiveness, all participants thought that the proposed method is less or just as intrusive as the classical method of advertisement delivery. 24% thought that it is considerably less intrusive and 36% that is just as intrusive as seen on Figure 5.8.

48% of participants were just as interested in the advertised product as they would have been with the classical advertising method. 40% were a little bit more interested and the product. 12% were considerably more interested as seen on Figure 5.9.

The general rating participants gave to the method of advertisement delivery is 3.96 on a scale from 1 to 5 as seen on Figure 5.10.

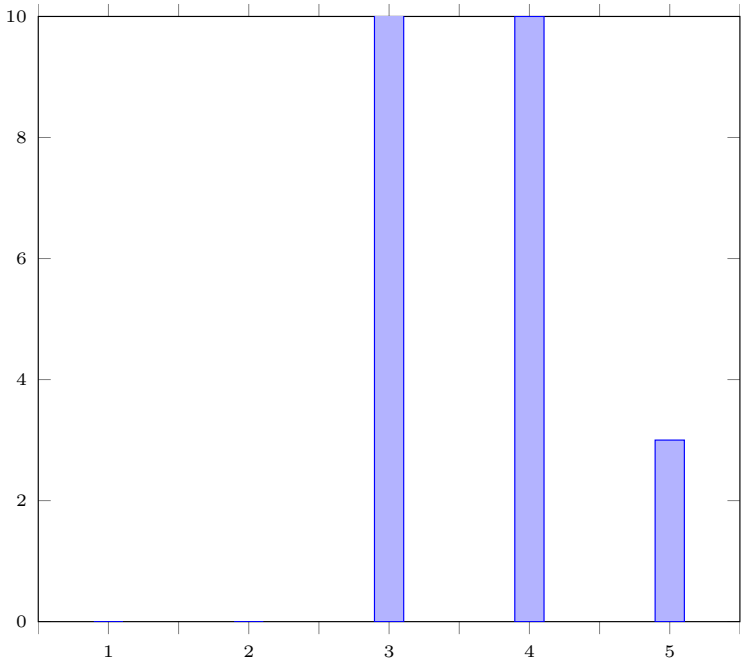


**Figure 5.9:** Interest comparison

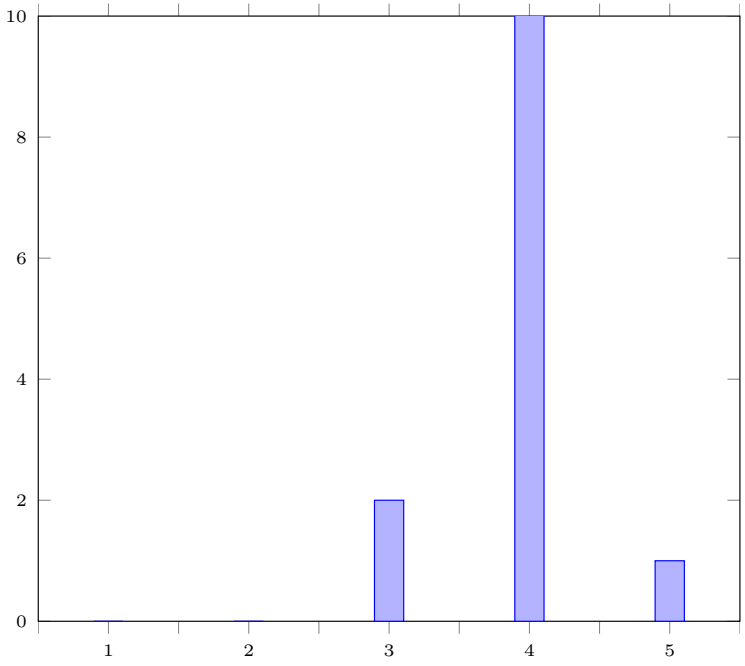


**Figure 5.10:** Rating

## 5.5 Summary

The feedback was mainly positive. Almost all users found that being able to move an advertisement around on the screen is something that they would like to do in mobile applications. Some found that, being used to classical advertisements, the fact that the advertisement can be interacted with is not very intuitive and needs instructions on first application launch.

Some of the participants are application developers and were more than happy to start using this method for application monetization if it ever became a feasible option.

# 6

# Conclusions

Sending personalised advertisements to a user's smartphone is one the most intimate advertising channels. The excessive use of it, however, has become a serious problem. Excessive amount of Advertisements in mobile applications degrade the user experience and make the user view the advertisements in a negative light. The effectiveness of such advertising as questionable as well.

A library was developed that presents advertisements in mobile applications in a more user friendly manner. It lets the user move it around on the screen according to need or move it off the screen altogether. If the user chooses to keep it on the screen for later viewing, the advertisement is small enough that it does not distract from using the application. In addition, users themselves can give feedback on the advertisements, which more accurately helps send the user more relevant advertisements in the future, instead of relying on profiling algorithms to decide the user's likes and dislikes.

However, the developed solution is just a proof of concept and has far a way to go for being usable in an actual real world solution. The client side of the library needs stability improvements and rigorous testing. The animations could be improved and the user interface made more intuitive to use.

The server-side needs to be built from scratch, with improvements in security and stability. Also, keeping in mind that an advertising framework needs to handle a large amount of users at any given time, which the current solution can not.

All in all, the feedback received from the control group was mainly positive. This gives hope that, in the future, a state can be reached, where mobile advertisements

are construed as a useful and positive thing by an application user, rather than an annoyance.

The developers can then monetize their application with advertisements, without having to worry about it degrading their reputation and the user's experience using their application and focus more on giving the users an application that is enjoyable to use.

# 7

# Appendices

## .1 Appendix A

1. How much do you use applications on a mobile device on an average day?

   1 2 3 4 5

2. Rate how much advertisements bother you when using mobile applications, where 5 is very much and 1 is not at all.

   1 2 3 4 5

3. If you chose more than 1, explain quickly what bothers you most about mobile advertising?

   _____

   _____

   _____

4. Have you even uninstalled and application just because of the intrusiveness of advertisements?

   YES NO

5. Have you ever looked up a product or service because you saw an advertisement of it in a mobile application?

   YES NO

6. Have you ever bought a product or payed for a service because you saw an advertisement of it in a mobile application?

   YES NO

7. Given the chance, how often would you get rid of an advertisement as soon as it appeared on the screen, without paying any attention to its content, where 5 is always and 1 is never?

   1 2 3 4 5

8. Given the chance, how often would you move an advertisement to a different location for later viewing, where 5 is always and 1 is never?

   1 2 3 4 5

9. Given the chance, how often would you give honest feedback on whether you like an advertisement or not to, in the future, get advertisements based on your interests, where 5 is always and 1 is never?

   1 2 3 4 5

10. How would you like advertisements in your mobile applications to be displayed to make their presence less disruptive?

    _____

    _____

    _____

11. Rate how you would compare this method of advertisement delivery to the classical one you see in mobile applications usually (banners, full-screen interstitials) in terms of intrusiveness, where 5 is considerably less intrusive and 1 is considerably more intrusive.

    1 2 3 4 5

12. Rate how you would compare this method of advertisement delivery to the classical one you see in mobile applications usually (banners, full-screen interstitials) in terms of your interest in the advertised product, where 5 is considerably more interested and 1 is considerably less interested.

    1 2 3 4 5

13. Give your general opinion about this method in a few sentences.

_____

_____

_____

14. Give a general rating about this method, where 5 is best and 1 is worst.

1 2 3 4 5

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