Mobile Technologies Supporting Corporate Loyalty Schemes

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Declaration

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Signed:

Abstract

I'll put my abstract here someday...

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Chapter 1

Introduction

1.1 Problem Description

Imagine the following scenario: A multinational tech company YanSoftware with offices worldwide wants to incentivise employees to cycle and visit the gym more often. It introduces these goals to contribute to the environment and improve general employee health. Several implementation options are available, such as posters, emails, websites, employee workshops, and campaigns; but another common method the business can adopt is that of a loyalty scheme. YanSoftware may have one or many of such schemes within their business to manage. Loyalty methods available to them range from the basic stamp/sticker book, to the more modern smartcards (Fig. 1).

Commonly, simple paper-based systems are adopted by businesses due to low cost and implementation times; nonetheless systems like these have several issues. Some individuals may lose their stamp booklets, some are concerned about the environmental impact associated with printing many cards of paper; furthermore, it is important to note that paper-based solutions are not very secure and open to abuse.

An opportunity exists for a general-purpose system to encompass loyalty programs via use of up-and-coming Near-Field Communication (NFC) technologies that are integrated inside modern smart phones. Moreover, elements of gamification can be added as an extra dimension of loyalty to corporate persuasive technologies. (e.g. unlocking better rewards as they level-up, essentially playing versus themselves)

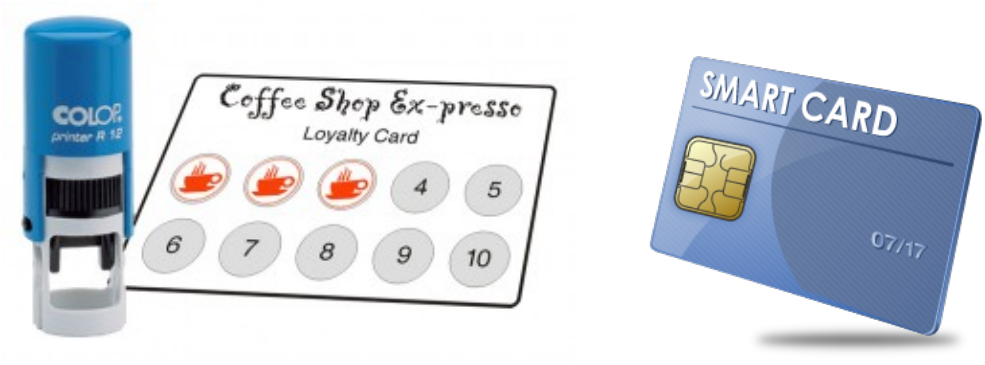

Figure 1.1: A paper stamp card & smart card

1.1.1 Rationale

The smartphone is now a staple item which many people cannot leave their home without. As of 2014, there is a worldwide user-base of approximately 1.75 billion smartphone devices (**?**). Migration to phones allow the business to have a central hub of all of their loyalty schemes, eradicating the need for paper. This means that issues relating to paper-based systems, such as printing paper (environmental impact) and people losing their stampcards are no longer an issue. Moreover, businesses will now have the option to track use and monitor their schemes for further analysis. This grants them insight into how many users they have, allowing them to adjust loyalty schemes appropriately.

On the other hand the proposed solution is not without some problems of its own. For instance, not everybody owns a smartphone, so hybrid smartphone/paper solutions will need to be considered. Additionally, there exists specific disadvantages of smartphones, such as dependence on battery life and an internet connection.

1.1.2 Aim

The aim of this project is to develop a general purpose solution using a smartphone that supports businesses in creating, managing and deploying a simple loyalty scheme - using gamification elements to engage the users. The specific technology chosen is NFC in phones running the Android operating system.

1.1.3 Objectives

- Research the state-of-art surrounding NFC technology within loyalty and gamification systems
- Examine and Analyse the current smartphone solutions available to manage loyalty systems
- Design and implement the solution
- Perform an evaluation on the different interaction cases and interfaces
- Look into the future possibilities of the system and the infrastructural requirements to support them

1.1.4 Similar Developments

There exist some similar mobile-based solutions to the one proposed, such as Apple's *PassBook*. Passbook is an iOS exclusive application that allows users to save their generic cards (i.e. boarding passes, event tickets, loyalty cards etc.) Though also a general purpose solution, there is a distinction on the technologies used (QR/Barcode Scanning) and the interactions presented to the users - For example, Passbook entails the one-way interaction

of simply scanning barcodes. By adopting the two-way possibilities provided by NFC, richer interactions can be built and allow inter-communication between devices.

Other loyalty applications also exist, some using some combination of NFC or gamification elements; nonetheless they are specific to their associated brand. Starbucks' application on iOS is one such example (Fig. 2), offering users a digital QR version of their Starbucks card (Fig. 2c) and a medium to collect rewards in the form of stars. These stars, along with the account balance can be used to claim rewards and beverages. The opportunity of our proposed solution is to make an encompassing general-purpose solution that any business, big or small, can use to simply implement a loyalty program.

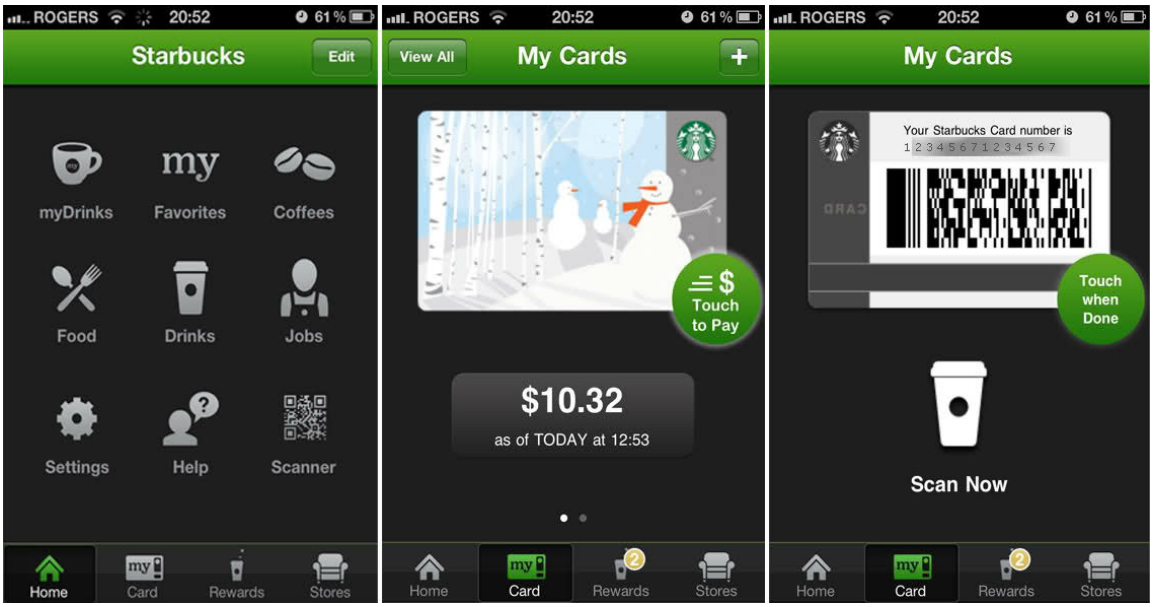

Figure 1.2: Starbucks application for iOS (a) The menu of the Starbucks app(b) The card and available balance (c) The bar-code presented to the baristas to scan

1.2 Resources

1.2.1 Technologies

Android Platform

Android is a smartphone operating system developed by Google. Along with Windows Mobile OS and Apple's iOS, these three operating systems are the biggest players in the global smartphone market. Android was chosen because most devices are equipped with an NFC chip and have well supported APIs regarding Host Card Emulation (See 4.1.4 Host Card Emulation). With the introduction of iOS8 and the iPhone 6, Apple now has support for NFC payments; however the APIs are unavailable to developers at this time and as a

result, cannot be used. Windows Phone has similar NFC libraries to Android, but was not chosen due to it's low market share (2.5% as a pose to Android's 84.7%)(**?**).

Android SDK

The Android Software Development Kit (SDK) Will be required to develop, implement and test the Android applications. There are several methods that can be chosen regarding Android application development without having to use Google's JAVA SDK. Unfortunately, due to the specific dependencies on Google's NFC APIs, development will need to be done using the JAVA SDK.

Google+ API (Sign in with Google)

This API allows users to use the system by means of their Google account. The rationale is to allow people to *one-click sign in* without having to worry about registering and logging into a new account. It is more secure having the user's account details on Google's servers, rather than creating and storing information for a brand new account. On the other hand, If users deem appropriate in the post-implementation evaluation, a separate registration process will be considered.

Host Card Emulation (HCE)

NFC chips can be placed into Card Emulation mode in such a way (ISO 14443) that a reader classifies it in the same manner as a smartcard.(**?**). Implementation of the system is dependent on use of this NFC facet. *Android Kitkat* supports this mode within its APIs.

1.2.2 Android Devices

For most cases of Android development, the bundled emulator with Google's Android SDK is sufficient; however due to the project's dependence on the NFC chip, at least two physical (preferably differently branded) devices need to be used. One will be running the Loyalty Manager, whilst others will be running the Loyalty Reader. Both devices must at least have the *Kitkat 4.4* iteration of Android in order to use Host Card Emulation.

1.2.3 Users

A group of individuals will be required to assess the different interfaces and interaction use-cases. Smooth interactions are important in order to both encourage and optimise use in fast-serving environments (i.e a coffee shop). General members of the public would be used for the Loyalty Reader, whereas input from business owners would be most valuable on the Loyalty Manager.

Chapter 2

Literature & Technical Survey

2.1 Introduction

This chapter will explore the state-of-the-art surrounding near field communication, gamification and persuasive technologies, along with some current solutions implemented by the industry.

It is anticipated that the main deliverable for this dissertation would be two Android mobile applications to facilitate the creation, deployment and management of a Loyalty Scheme. As such, we will need to discuss the pressing research, benefits and issues that encompass creation of 'sticky' technologies on mobile platforms.

2.2 Near Field Communication (NFC)

Near Field Communication (NFC) is an up-and-coming wireless technology that is currently being adopted in many contexts. Using this proximity-based standard, Two individuals can share data by placing NFC-enabled devices within a few inches of eachother.(see example in Figure 1.1). The standard was first established by Nokia, Philips and Sony in 2004 to define next generation radio frequency communications (**?**).

Figure 2.1: Using the smartphones NFC chip with a VISA application on a wireless card reader as a form of contactless payment

2.2.1 Technical Fidelity of NFC

NFC is a close relative to Radio Frequency Identification (RFID), using the 13.56 MHz radio frequencies under 424Kbit/s bandwidth (**?**); however it operates at a far shorter range (10cm versus 100m). As with RFID, there are two types of NFC devices - powered and unpowered. Powered devices surround themselves with an ultra-low power electrical field, inducing electric potential to other NFC devices within range; whereas unpowered devices (also known as "tags"), rely on this electric potential from powered devices as a power source during the interaction.

NFC devices can adopt several different modes for different interactions (**?**)

Tag Reading/Writing A powered NFC device in this mode can read and write information stored in tags. Websites, contacts and telephone numbers are commonly encoded in this manner. Upon reading the tag, it is the software's responsibility to act on the data in an appropriate manner (**?**)

Host Card Emulation NFC chips can be placed into Card Emulation mode in such a way (ISO 14443) (**?**) that a card reader classifies it in the same manner as a smartcard. NFC devices can keep different cards in storage and switch between emulating them as required. (**?**)

Peer-to-Peer Two powered NFC devices can bidirectionally share information between each other - for instance Bluetooth pairing information. (**?**). In the case of a business environment, authentication can take place between two devices in the same bidirectional manner (**?**) as a form of 'secure log-in'.

2.2.2 NFC as an Interaction

lorem ipsum

2.2.3 Applications of NFC

Wireless communication technologies such as NFC have been around for some time. Many electrical devices with the capacity to communicate already use Wi-Fi, Infrared or Bluetooth; eventually these technologies make their way into modern smartphones and other domestic devices. Due to the openness of the NFC standard, there are a wide plethora of implementations facilitated by the technology:

Contactless Payment/Mobile Wallet Starting from 2005, banks began integrated contactless chips inside debit/cards for payments under 20 (provided that the card reader supported contactless). From 2011, several large players such as Google, Apple and Paypal have developed mobile wallet applications, with Google and Apple primarily supporting NFC. Contactless cards too rely on the (ISO 14443) (**?**) smartcard standard, complementing the previously discussed host card emulation, allowing an NFC chip to emulate an identical smartcard. Whereas, contactless debit and credit cards are prevalent, Google Wallet and Apple Pay are not available outside of the US Market, reasonings being ill-documented.

Ticketing Contactless ticketing has been available for a while, the Oyster card being an iconic example; nonetheless it has the issue of being a proprietary, locked down technology. In 2014, contactless cards have been enabled within the system, some arguing that this was to the cost of maintaining the Oyster framework (**?**). The contactless acceptance also infers that mobile wallet applications would also be able to take advantage of these readers.

Gaming Game designers have always looked for ways to make video games more engaging. There are two methods in which they can implement NFC within their games, with the intent to make **Pervasive Games**. Such games expanding the play space into the player's ordinary social life (**?**). Firstly, they may may use NFC to enrich collaboration and sociability. As an example, a study was done with two identical games, one with NFC and the other without. Tests were ran with two groups of individuals and findings showed in increase in positive experience for NFC (M=9.0, SD=3.7) over touchscreen (M=4.8, SD=2.2) (**?**)

The second way and more recent way NFC can be implemented in video games is through physical-digital mappings. The *Wii U* video game console contains an NFC chip in the controller, allowing users to use NFC enabled figurines on the controller. The result of tapping these devices together makes figurines appear within the console as in-game characters.

Loyalty Schemes Loyalty using NFC is a topic that is is still being explored by industry. As such, there are some different and creative implementations available. The original NFC Loyalty solutions came in the form of staff/store cards; however with the advent of NFC in mobile phones, pervasive solutions have been implemented. For example *Orange EAT*has a scheme where people can tap specific NFC posters and tags in order to gain free rewards

in the form of food and drink (**?**). There are several other prototype solutions available; nonetheless they were not properly adopted as NFC is not available for all phones. In addition there are only 200,000 NFC enabled customers on Orange (Less than 1% of the total customer base) (**?**).

2.2.4 NFC in Phones

NFC functionality in phones is actually not a new concept, phones with NFC chips have been around since 2006, but the adoption of NFC with manufacturers did not get popular until 2010 when a set of peer-peer standards were released to transfer meaningful information (contacts, URLs and bluetooth) (**?**). Since then, popularity took off, with IHS[1] predicting that 939 million NFC enabled handsets would be shipped in 2018 (Figure 1.2) (**?**).

World Shipments of NFC-enabled Cellular Handsets

	2013	2014	2015	2016	2017
Millions of Handsets Shipped	275	416	575	797	939

Source: IHS Inc., February 2014

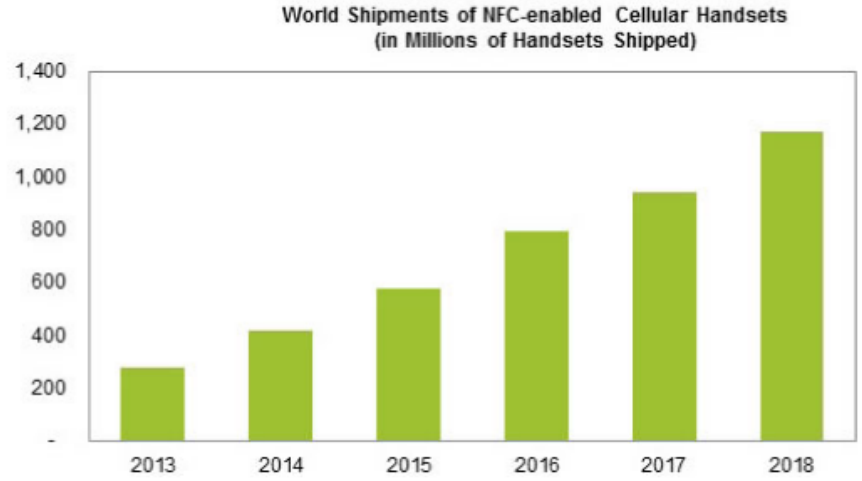

Figure 2.2: A chart depicting the predictions of mobile phones shipments that have NFC built-in

interestingly, of all the applications mentioned in the above section, **all** of them have been implemented both with and without mobile phones. The advantage of using the mobile phone is that it has the capability to consolidate a potentially infinite amount of nfc cards, tags etc into just one chip.

Software support for NFC is something that must be accompanied with hardware. Android and Symbian received support in 2011, Microsoft in 2012 and Apple in 2014. The fact that these implementations are very recent can be attributed to the rising culture of NFC use.

[1]IHS inc is a data and critical information provider for the technology industry

2.2.5 Areas of Research

In 2010 a survey was done of academic papers surrounding NFC (**?**). The authors gathered a total of 74 research and used content-oriented classification (**?**) in order to split up NFC papers into four categories: NFC Theory, NFC Applications, NFC Infrastructure and NFC Ecosystem. The results of their findings are shown below:

Classification	Description	Number of Papers	Percentage
NFC theory and development	The concepts and developments of NFC, along with future recommendations and ethics	15	**20.3%**
NFC Applications and Services Reader-Writer Mode Applications Host Card Emulation Applications Peer-to-Peer Applications	Discussing or developing different implementations of NFC applications and services based of NFC modes	30	**40.5%** 25.7% 13.5% 1.35%
NFC Infrastructure	Types of NFC technologies and their applications in the real world, also security and privacy	22	**29.7%**
NFC Ecosystem	frameworks for businesses that want to integrate NFC culture & models and strategies into their processes	7	**9.5%**

It can be observed that a huge proportion of NFC literature (40%) at the time was heavily focused on developing prototype applications and services. However, the specific types of applications were primarily 'Reader-Writer' mode as this was just before the introduction of NFC peer-to-peer standards.

The research identified that there was a gap in researching the development of NFC principles and theories or how to integrate such solutions into business models. As a result, we can argue that this business-orientated business gap was a factor for the slow adoption of NFC.

2.2.6 Limitations of NFC

The key limiting factor of NFC for the longest time was the slow adoption rate by businesses and manufacturers. Contactless payment, the predominate form of NFC interaction depended on specific NFC card readers to enable contactless functionality; furthermore we cannot underestimate the amount of effort it takes to introduce a new billing option to a country.

Analytics also show that NFC implementations are very fragmented (**?**). This can be attributed to two reasons: the openness of the NFC platform encouraging different implementations and businesses wanting their own implementation for their own needs. For instance, in the example of loyalty schemes, each business might have a separate loyalty application which the customer needs to download and setup. These applications allow businesses to perform their own tracking and branding.

2.2.7 QR and NFC

2.3 Gamification

Over the years, a keen topic of research within Human Computer Interaction is that of user engagement. There are several different design models that afford this goal. One recent and popular example being gamification.

Gamification can be best described as

> "An informal umbrella term for the use of video game elements in non-gaming systems to improve user experience (UX) and user engagement." (**?**, p. 2425)

The need for gamification comes from the modern zeitgeist of the digital world, a world of engagement. Comparing the current opportunities for entertainment (i.e. video games, social media, the internet) to those from fifty years ago, provide users with much more choice. Furthermore, users are no longer registering traditional advertising in the same way they did fifty years ago. A study done with university students using eye-tracking technology with *Facebook* shows that students perceive less than a quarter of the site's adverts (**?**). Experimenters concluded that this was due to users scrolling the timeline too quickly and learning where advertisements appear, therefore ignoring those areas.

By harnessing the power of play, designers can apply motivational affordances to improve user engagement. Gamification techniques are predicted as the future of marketing (**?**), with Gartner[2] stating that 50% of companies with innovation processes will incorporate gamification by 2015 (**?**).

2.3.1 History

The principles of "turning things into games" are actually not new. They have long been employed by parents and teachers to make activities seem more enticing to children; however applying game-like aspects to a business environment was only formally introduced in the 80's (**?**). The word *Gamification* was coined in 2002 by Nick Pelling, an early computer games programmer that wanted to apply game-mechanics to different contexts (**?**). Recently, gamification has become a buzzword amongst modern system designers. The rise in popularity can be shown in a Google Trends search (Fig. 1). This boom can be attributed to soaring video game popularity and cheap enabling technologies found in modern domestic appliances (i.e GPS, Internet Access, Bluetooth etc.) (**?**)

[2]Gartner is an IT research and advisory business

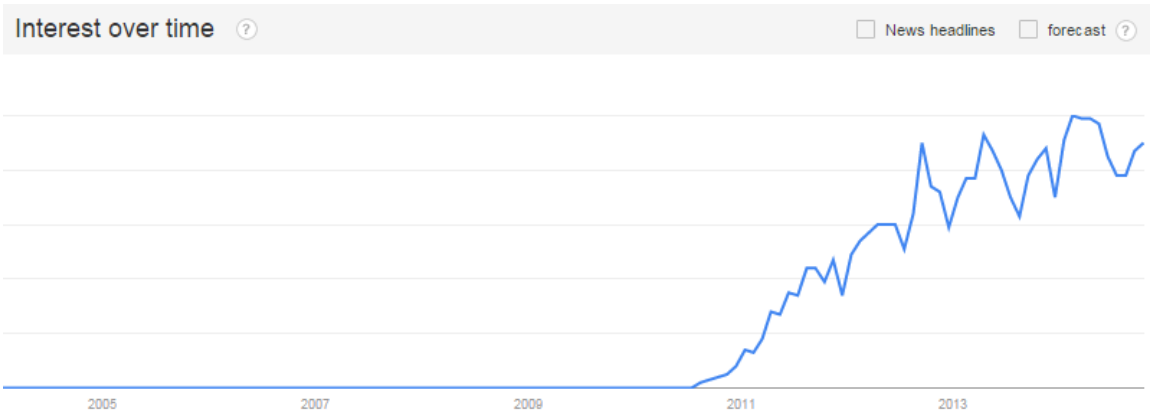

Figure 2.3: Google Trends graph depicting the search popularity of the term **Gamification** over the years

The use of gamification has also shifted over the years. Many reseachers (**?**)(**?**) consider Charles Coonradt as pioneer in the field of gamification. In his acclaimed book *The Game Of Work* (**?**), Coonradt introduces "game-like concepts" inspired from sports as a means to increase employee productivity, satisfaction and motivation (**?**). On the other hand, gamification in the digital age takes inspiration from video games to to improve user experience, engagement and loyalty. (**?**)

It can be argued that the two inspirations (sports vs. video games) present us with different flavours of gamification. Games of sport entail clear goals, instantaneous feedback, and the concept of striving to be better. Video games aim to keep players playing by providing psychological rewards such as achievements, unlocks and ability to compare their skill with their friends. Even though these two methods of gamification have some differences, their main shared trait lies in the way they play on our natural instinct of socialisation and competition. (**?**)

2.3.2 Gamification and Mobile Technologies

Although elements of gamification can be found in a variety of systems, mobile technologies have seen biggest boom in gamified systems. As mentioned earlier, a major contributer to this boom is the prevalence of cheap enabling technologies such as bluetooth, and GPS - all of which can be found on a modern smartphone. In 2009, Foursquare was one of the first successful gamified mobile applications; allowing users to "check-in", collect badges and receive recommendations on where to go next (**?**). Five years later, Gartner predict that 70% of the top 2000 companies would have a gamified application by the end of 2014. (**?**)

2.3.3 Areas of Research

Areas of research of gamifcation using certain elements...

2.3.4 Critiques of Gamification

The application of gamification practises to digital applications is prevalent amongst business applications (**?**), nonetheless these practises have attracted criticisms. One view adopted by the video games industry is that gamification mistakenly portrays "game-like" properties, such as levels and scores as part of human behavioural complexity. (**?**). Moreover, there are negative "exploitative" connotations (discussed later) to word gamification in the business world; therefore businesses generally prefer the term "motivational design" instead.

The concept of creating "sticky" systems via gamification techniques can also present us with systems that affect user behaviour negatively. The McDonalds Monopoly sweep-stake is a well known example of this phenomenon. The promotion involves the collection of monopoly stickers containing prizes from purchasing certain food and drink (more stickers with larger meals). Paxman et al (**?**) introduce examples where consumers change their purchasing habits in order to maximise the number of stickers they receive, linking these changes to childhood obesity (**?**). Several theories of motivation exist explaining these behaviours; however Zichermann (**?**) considers motivational factors as unruly, yet admits "once you start giving someone a reward, you have to keep [them] in that reward loop forever" (**?**, p. 27).

2.4 Persuasive Technologies/Captology

Capturing the attention of an person for the purposes of persuading them is a problem that sympathises with many. Businessmen, politicians and teachers alike are examples of such professions - more specifically professions where persuasion is an integral factor of their success. There exist a plethora of methods to achieve this, for instance salesman study marketing, politicians study public speaking, whilst those in the realm of technology study captology (the art of persuasive technologies).

We can define 'persuasive technologies' as:

> Solutions which are designed with a purpose to change attitudes or behaviours via persuasion and social influence, but not through coercion (**?**)

BJ Fogg, considered by many (**?**)(**?**) as a pioneer in the discovery and research of captology, identifies the art as an intersection between technology and persuasion (Figure x).

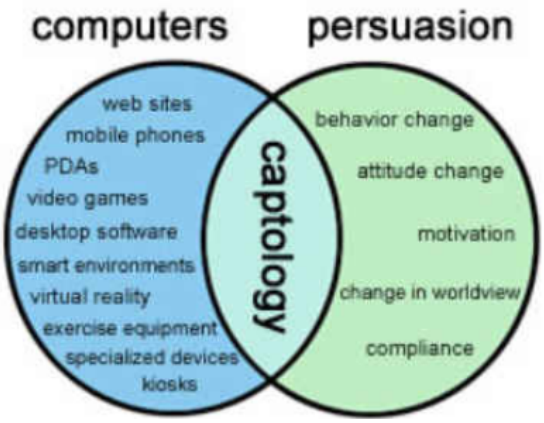

Figure 2.4: A Venn diagram showing the intersection of persuasion and technology - Captology

2.4.1 Types Of Motivation

It is also helpful to mention the types of motivations which affect people to do activities. Literature indicated that there are three main types of motivators that drive people to behave in a certain way, Deci and Ryan from the American Psychological Association (**?**) define them as:

Tangible Motivation Incentives where motives to enact the task are not related necessarily to that specific behaviour - *Completionism*

Tangible motivation takes the form of leveraging the human Psyche. For instance, the example of a progress bar persuades the user to bring it up to 100%. The user may not be specifically motivated to perform the task, but they are motivated to complete the progress bar.

Intrinsic Motivation The act of making the intended behaviour so pleasurable that it becomes an end in itself - *Gamification*

The philosophy of this motivator is to persuade the user to engage with the activity in a way that they enjoy. Gamification exists within this realm of motivation, making activities more enticing to users.

Extrinsic Motivation External Incentives driving the motivations - *Rewards/Money*

These motivators usually offer some sort of reward such as money to entice the user to perform an action. Although only considered as short-term, it is useful at incentivising one-off activities that are difficult to make engaging, for example surveys.

Persuasive technologies afford the use of any combination of these to develop systems. (perhaps give examples)

2.4.2 Fogg's Taxonomy

Fogg characterises each persuasive technology by *functional roles* (**?**), of which technologies can identify as one or several of these categories. The proposed triad is designed to model the way in which users see and react to the following:

Tools These technologies are designed to make people's jobs easier(**?**). For example a wizard or an Out of Box Experience (OOBE) can give users direction regarding the completion of a specific or complex user task.

Media Media-centric technologies are designed to provide users a platform to create experiences that develop, teach or enforce a behaviour. These can come in the form of games, interactive systems or stories; the best examples however are simulations. Simulations place the users in a specific environment where they must interact with rules of the system in order to hone a required set of behaviours; such behaviours can be for the purposes of testing or real-life skills.

Social Actors With the introduction of social actors, computer systems can now influence users using social cues. Actors can be persuasive by giving a human face to positive feedback, modeling an inded behavior or provide moral support to the user (**?**). Research in this area is constantly developing as it's difficult to build 'human' characters without entering "uncanny valley".

2.4.3 Persuasive Technologies Through Gamification

Persuasive Technology is a broad term. As such, it can be argued that gamification exists within the realm of captlogy; nonetheless there exists the key differentiators of scope, more specifically - gamification is not necessarily linked to technology (although 'gamified' technologies are generally more common).

Figure 2.5: The piano tiles staircase

The Piano Stairs are a well known case study of implementing persuasive technologies using gamification (**?**). In this example, tiles and speakers in the configuration of a piano were installed next to an escalator, each stair playing a specific note on the piano when stepped on (Figure xx). The purpose of this experiment was to get more commuters to take the 'healthier' stairs rather than the escalator. Results showed that people were taking the stairs frequently and in more 'musical ways', with some musicians attempting to play songs using them. There was however another factor that encouraged people to take the stairs, curiosity (**?**). The staircase is so out of place that people are curious and thus want to explore and engage with the technology.

Applying the concept of Fogg's taxonomy and motivator types, this innovation is an example of a media-oriented technology, fueled by intrinsic motivation - making the act of going up the stairs more enjoyable. Although further empirical information is unavailable, it would be interesting to see whether these stairs impacted people's choice of taking other stairs in the future.

2.5 Survey of Solutions

We now turn our focus to the developed solutions. These technologies were chosen as they use a combination of NFC, gamification or persuasive technologies. The first group will contain implementations dedicated to a certain business; whereas the second will look at more generic applications. The chosen solutions were only those where **Loyalty** was the core function of the technology, 'ecosystem-based' combined solutions were not considered.

In order to summarize these technologies later, each of the following should answer these questions:

- How does the user interact between the real world and the applications (what pervasive elements does the application possess)?
- What elements of gamification exist?
- In what ways are multiple loyalty schemes presented?
- Are there any subtle persuasion techniques employed?

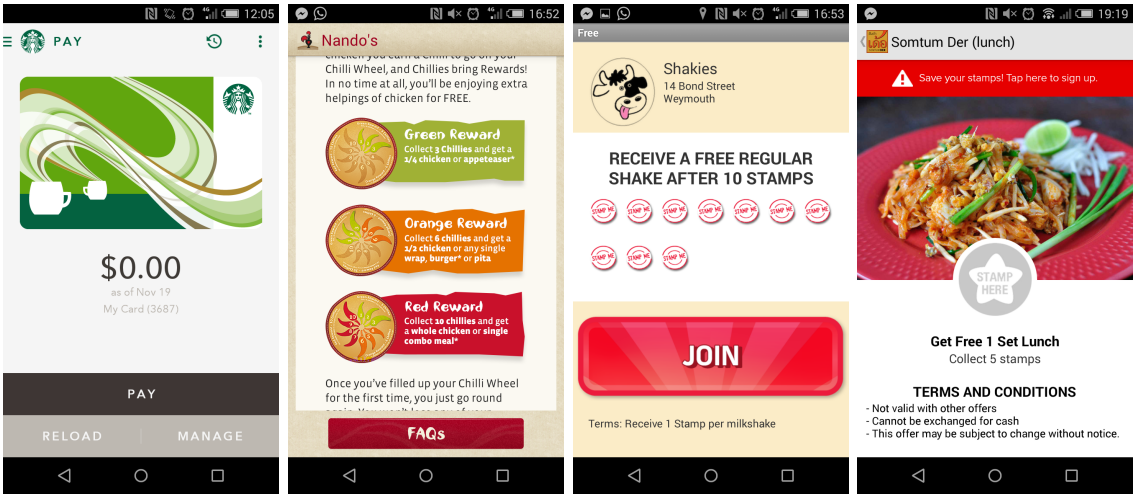

Figure 2.6: The piano tiles staircase

Overview

2.5.1 Starbucks Mobile Application

The Starbucks mobile application is designed as a digital-companion to the standard plastic loyalty card they provide. The application allows user's to either have a digital-only card or transition their physical cards onto the app, allowing customers to view, top up and pay with their balance.

What are the pervasive elements and how are they acheived? Aliased Card

Using Barcode

What elements of Gamification exist? Collect Stars with each purchase, free drink on 15, upgrade to gold member (levelup!)

In what ways are multiple loyalty schemes presented? The user can have up to 10 Starbucks cards

Are there any subtle persuasion techniques employed? Extrinsic Motivation of filling a cup, personalise your card

2.5.2 Nandos Mobile Application

Overview

As with Starbucks, the Nandos' mobile application works in a very similar manner to the starbucks card. It allows users to register their current physical card; however this app is purely as a companion, informing users of the status of their loyalty points in the card. **What are the pervasive elements?**

Users can see their chilli count.

What elements of Gamification exist?

In what ways are multiple loyalty schemes presented? it is not possible to have more than one loyalty scheme on this application. **Are there any subtle persuasion techniques employed?**

When a users connects their card to the app, A wheel with different colored chillis are displayed. In order to get rewards, users must complete the wheel, displaying the example of extrinsic motivation via completionism - encouraging users to fill the wheel.

2.5.3 StampMe & Stamp

Overview

StampMe & Stamp are both general purpose loyalty application for corporates to implement loyalty schemes. Businesses can only have one loyalty scheme that mainly adopts the "free x with y stamps" methodology. Users can browse for nearby shops that have available offers and collect numerous schemes.

What are the pervasive elements?

In order to gather a stamp from these apps, the business uses a proprietary digital stamping device to stamp the screen of the mobile phone, thus transferring a stamp. Although this is an interesting way to stamp the screen, information about the specific technology it uses proved impossible to find. It can however be inferred that this technology is not NFC as it works on both iOS and Android.

What elements of Gamification exist?

Outside of collecting stamps, no other offers or gamification elements are implemented within these applications.

In what ways are multiple loyalty schemes presented?

Once a user 'joins' a business' loyalty scheme, it is added to a list of their current loyalty programs. The list is made out of simple text and does not display any information about the progress of the schemes - unless they explicitly click on the name of the business first.

Are there any subtle persuasion techniques employed?

Other than allowing users to find nearby participating business, There are no other persuasion techniques employed.

2.5.4 Summary of Solutions

insert table for solutions here

2.6 Conclusions

Although there do exist some general purpose loyalty solutions, they lack the polish and feel clunky as a pose to business-centric applications. On the other hand, those applications that are business-centric require users to install a mobile application for each loyalty card. Whereas large businesses have the resources to create such highly customised, high-fidelity systems, small businesses have little incentive to invest outside of paper-based solutions, mainly due to large development and implementation costs.

NFC with social elements is an area vastly untapped by businesses, mainly due to the slow uptake of NFC by the market; moreover it seems like those loyalty systems using NFC seem to be constantly re-inventing the wheel instead of using the open standard.

The opportunity of our proposed solution is to make an encompassing general-purpose solution that any business, big or small, can use to simply implement a loyalty program and push it out to any users of the application; collecting 'stamps' using NFC. All loyalty schemes will be automatically incorporated into a gamification framework provided by the application, providing businesses a gamified loyalty scheme with minimal effort.

Chapter 3

Requirements & Design

3.1 Introduction

This chapter describes and outlines the requirements for the proposed software solution. Requirements will set goals for the functionality of the software, whereas the design section allows us to translate these requirements onto paper. Both sections will become useful when testing whether the system is fit-for-purpose.

3.2 Requirement Methodology

In this section, system requirements will be presented. Two sources of requirements were used: firstly using information discovered from the literature survey; and secondly from an interview from a project manager at 'Company A'. These requirements are not to be used as an exhaustive list, but are to be used as a benchmark for ensuring the created product is fit-for-purpose.

3.2.1 The Interview

To gather business oriented requirements, an interview was conducted with a project manager, specialising in IT implementations for corporate facilities. several points discussed were integrated into the system as requirements. For instance:

6. What do you think of this solution? (The corporate loyalty app)

For this solution to be feasible and useful, it would need to be:

- Available for all of our permanent staff to use
- Easy integration for further sites and users globally
- Good usability aspects. GSK has 100,000 staff members with a variety of demographics, therefore all users should find it easy to use and better than the existing process
- The system would need to increment on a daily basis when the staff members enter site (once a day only)

Informed requirements M2, S3, S4, and C4.

The transcript of the interview can be found in the appendices.

3.2.2 Requirements

Our solution involves the creation of two Android applications, thus the requirements below will be marked whether they are for **Both** or exclusively for the **Loyalty Manager**, or **Loyalty Reader**. Effort will be made to maximise cross-system requirements. We found that there was an abundance of potential system requirements, however not all can be implemented in good time. As such, we present these requirements in MoSCoW Format (**?**) (Must Have, Should Have, Could Have, Won't Have) in order to categorise the importance of their delivery.

Must Have

M1 **Sign-In & Registration**
The user should be able to sign in with an existing account or register for a new one
[Both Systems] — Functional

M2 **Fast Stamping**
Access to the NFC stamping functionality should be available within a single tap from a home page
[Both Systems] — Functional

M3 **NFC Transmission**
The system must use NFC for data transmission and Host Card Emulation
[Both Systems] — Functional

M4 **Online Syncing**
The system must be able to sync a users 'stampbook' online
[Both Systems] — Functional

M5 **Sync on Interaction**
Syncing must take place as soon as there is an interaction that affects the stamp count of a scheme
[Both Systems] — Functional

M6 **Syncing Time**
The response time for syncing must be within 5 seconds
[Both Systems] — Non-functional

M7 **Feedback on Interaction**
The system must provide audio/visual feedback whenever a 'stamp' has taken place
[Both Systems] — Functional

'Must have' requirements are the minimum amount of features to be satisfied for the success of the system. As a result, these are of highest priority. Requirements defining gamification are not listed here as they are not 'key' to the system.

Should Have

S1 **Consistency**
The system should fit within the standards and design language of the Android operating system
[Both Systems] — Non-functional

S2 **Secure Communications**
NFC Communications between devices should be encrypted
[Both Systems] — Functional

S3 **Rewards Browsing**
The user should be able to easily browse their rewards available
[Loyalty Reader] — Functional

S4 **Levelling System**
Users should be able to level up each of their loyalty schemes independently (20 - gold, 50, platinum)
[Loyalty Reader] — Functional

S5 **Level-Restrictions**
Rewards should have a minimum-level required in order to claim
[Loyalty Reader] — Functional

S6 **Badges**
Users should be able to collect badges upon completing certain goals
[Loyalty Reader] — Functional

The 'should have's' represent features which should be included if the system if time permits. Generally these requirements add a layer of usability and engagement to the system; as such, most of the gamification implementation is defined here.

Could Have

C1 **Branding**
The system could provide deep customisation options for each scheme
[Loyalty Manager] — Functional

C2 **Personalisation**
The system could allow users to customise the appearance of their profile
[Loyalty Reader] — Functional

C3 **Passive Card Emulation**
The system could allow passive host card emulation
[Loyalty Reader] — Functional

C4 **Restricted Schemes**
The system could allow for account-specific schemes (only authorised users have

access to the scheme)
[Both Systems] — Functional

C5 **Internet-Free Stamping**
Users could have the ability to gather stamps without being connected to the internet (facilitated by the Manager)
[Loyalty Manager] — Functional

C6 **Multiple Device Support**
Users could be able to login and use multiple devices seamlessly
[Loyalty Reader] — Functional

C7 **Transaction History**
The system could have a transaction history to allow users to see their recent activity
[Loyalty Reader] — Functional

These requirements represent bells-and-whistles requirements. Features in the 'could have' are desirable but not a necessity to the project's initial builds. Incorporations of these requirements into future builds of the system would greatly benefit user experience.

Won't Have

W1 **Payment Options**
The system will not facilitate any form of payment
[Both Systems] — Functional

W2 **Loyalty Sharing**
Users will not be able to transfer stamps between friends/accounts
[Loyalty Reader] — Functional

'Won't have' requirements are simply outside the scope of the project. Their functionality is either not the purpose of the system (W1), or facilitate unwanted features into the ecosystem (W2).

3.3 Design

3.3.1 Outline

Turning our attention to the design, here we present the system, matching the requirements, outlining how they meet the system requirements. Some interesting scenarios have been mentioned in the requirements that leave a wide scope of design challenges. A study is also undertaken that involves participatory design as an extension of the proposed design - in effect, asking potential users to tackle these challenges.

3.3.2 Interacting With The Three Components of the System

As mentioned earlier, the proposed system involves two separate Android applications. However, in order to meet functional requirements M1, M4, S4, S6, C4 and C6 a database will need to be introduced in order to inter-connect user accounts, along with any relevant data (i.e. loyalty schemes, stamps and badges). Furthermore, a database is also useful from a security and continuity standpoint. For instance, backing-up stamps and schemes allows users to sync their accounts between phones, as well as preventing 'abusive' users from modifying the local variables for stamp count.

3.3.3 Modeling The Interaction

The key design challenge of the system is to ensure seamless and correct communications via NFC between each of the three system modules. As outlined in the literature survey, there are several modes that NFC can adopt (**?**), each changing the device's role as part of the interaction. In this case, Host Card Emulation (HCE) and NFC Readers can be setup in different configurations to facilitate these communications. Two such configurations were considered - Loyalty Manager using HCE and Loyalty Reader using HCE (Fig. 3.1). The difference between these configurations is small; however they each have distinct connotations. A discussion on their implications follows:

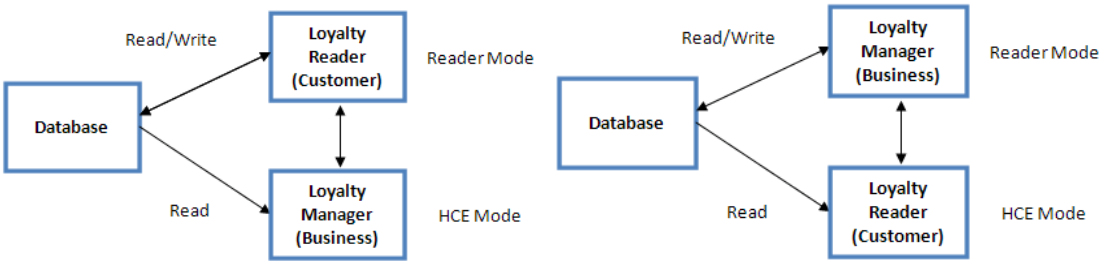

Figure 3.1: (i) Loyalty Manager using HCE. (ii) Loyalty Reader using HCE

Loyalty Manager using HCE

Loyalty Manager with HCE entails using the Manager application as a smartcard. In this case, the Loyalty Reader interfaces with the database to update the user's Stampbook.

The benefits and drawbacks of this configuration are:

+ Syncing is not necessary as the Reader will always have the updated Stampbook
+ Less logic required in the Applications to direct stamps
— Dependant on both applications having internet connection
— The user must have the Loyalty Reader open to collect stamps
— Data integrity issues if people maliciously modify code of the Reader
— Differentiating between reward & stamp requests is difficult

Loyalty Reader using HCE

When the Loyalty Reader acts as the smartcard, several interactions differ. Primarily, the burden of dealing with the database is placed onto the Loyalty Manager.

The benefits and drawbacks of this configuration are:

+ The Loyalty Reader does not need to have the application open to collect a stamp, the phone functions as a passive smartcard.
+ Only the Loyalty Manager needs access to the internet. Customers will be able to collect and expend stamps whilst not connected
+ The Loyalty Manager can easily separate stamp requests from reward requests
+ Data is more secure as only the authorised Loyalty Manager has access to modify the database. Ultimately, this prevents user tampering and ensures data integrity within the system
— Complex logic required in both applications
— Providing specific feedback directly to the Loyalty Reader via the app is difficult

Chosen Model

Loyalty Reader using HCE was selected on the merit of its positives. Primarily, not requiring internet access from the customer, the ability to collect stamps without having the application open and the emphasis on security. On the other hand, it makes the implementation trickier, requiring more logic to support the two-way communications. None-the-less, we expect that this model will ultimately benefit the system by making it easier to use and understand for users.

3.3.4 Design Methodology

In order to develop the designs for the system components, we b

Design Language

One of Neilson's heuristics is 'Consistency and Standards' (**?**), in this case meaning that the solution should follow the platform conventions and design of the Android operating system. This was captured in the requirement S1. If this heuristic is met, users will feel more comfortable as the system presented to them feels familiar to use. The latest standards outlined by Google describe *Material Design* (**?**), a visual design language to be used with the new *Android Lollipop* operating system with a goal to:

> *"Develop a single underlying system that allows for a unified [user] experience across platforms and device sizes"* (**?**, Introduction)

3.3.5 Design Process - Systems

Wire-Frame Mockups

INSERT ORIGINAL DRAWN MOCKUPS HERE

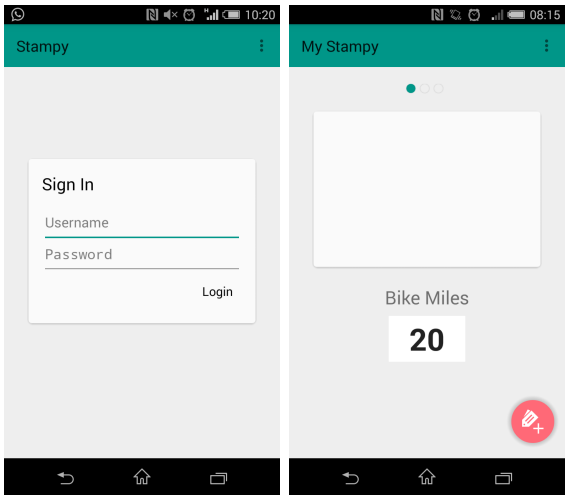

Figure 3.2: Prototype

Overview

3.3.6 Participatory Design

Need for Study/Problems With Guidelines

Aims

Outline

Results

3.3.7 Database Design

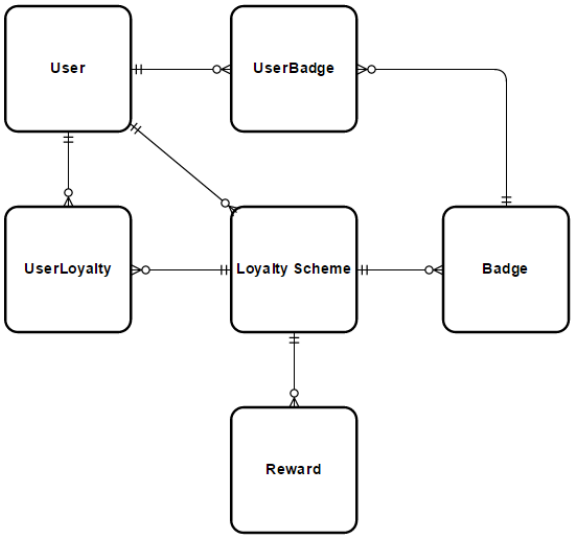

Figure 3.3: Entity Relationship Diagram

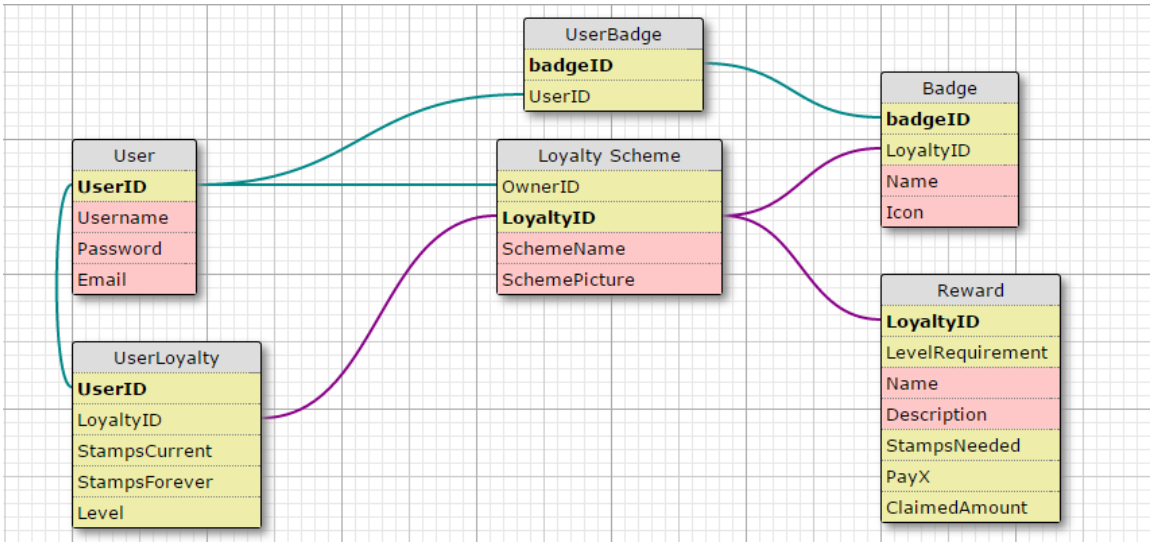

Figure 3.4: Database Model

Chapter 4

Implementation

This is the chapter in which you review your design decisions at various levels and critique the design process.

Chapter 5

Evaluation

Chapter 6

Results

This is the chapter in which you review the outcomes, and critique the outcomes process. You may include user evaluation here too.

Chapter 7

Conclusions & Future Work

This is the chapter in which you review the outcomes, and critique the outcomes process. You may include user evaluation here too.

Bibliography