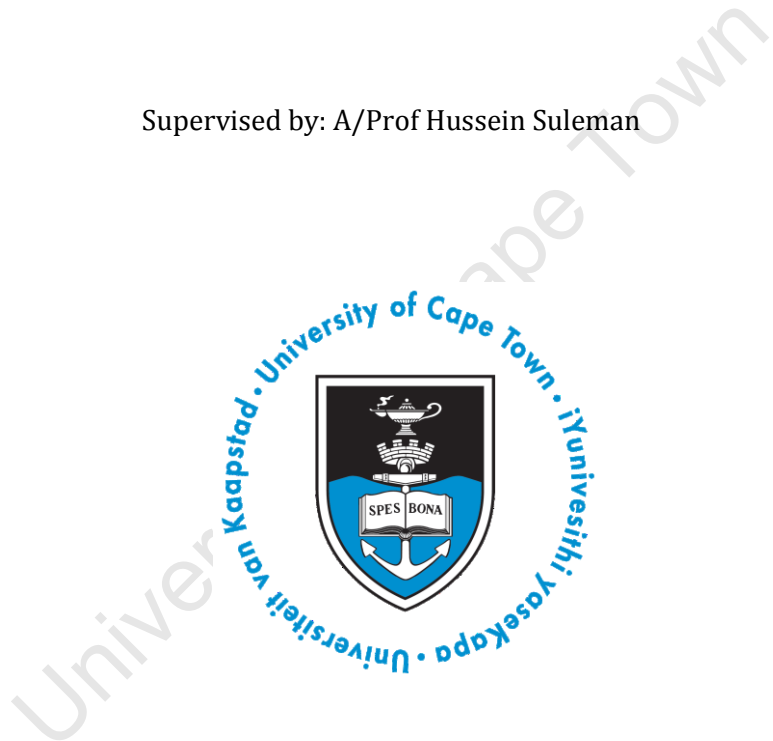


BUILDING HERITAGE COLLECTIONS USING GAMES ON SOCIAL NETWORKS

by

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Submitted for the Degree of

Master of Science

In the Department of Computer Science

University of Cape Town

· April 2012 ·

PLAGIARISM DECLARATION

I know the meaning of plagiarism and declare that all of the work in this dissertation, save for that which is properly acknowledged, is my own.

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ACKNOWLEDGMENTS

I would like to thank my supervisor, Associate Professor Hussein Suleman, for his guidance, honesty and support during this project. Thank you to the members of the Digital Libraries Laboratory for your useful discussions, assistance and recommendations. To all the participants of the focus groups and surveys, thank you for your time. Thank you to Min-Young Wu, whose experience and assistance was invaluable. To my parents Bernard and Lucille Katz, thank you for all your love and encouragement. I would like to thank my husband Eric Havenga for your love, support and pep talks. Most importantly, thank you to my God, without whom nothing is possible.

This research was funded by the National Research Foundation (NRF) and the University of Cape Town. Opinions expressed and conclusions made by this research are those of the author and not of the funders.

ABSTRACT

The collection of heritage data is a time-consuming and expensive process and is often dependent on project funding. However this is not sustainable. Therefore it is necessary to find cost-efficient and time-efficient ways of preserving heritage data. A solution may be to exploit social networks and the way in which people interact. An application on a social network may provide a means to avoid the cost, decrease time and increase scale of operation of heritage preservation by motivating users to supply and process the data. This project uses a Facebook application for the purpose of gathering heritage pictures and useful metadata and tagging. The application was written in Python using the Django Web Framework, connected to Facebook using the Graph API and was hosted on an Amazon Elastic Compute Cloud instance. Motivation techniques to promote user participation were investigated. Specifically, three systems were compared. The first had no social interaction or direct motivation of users. The second had social interaction and motivated users through competition using scores and a leaderboard. The third was also social, however without competition, where users were motivated by badges. An evaluation of these systems showed that direct competition was a more effective motivation mechanism to encourage contribution. Therefore the final application motivated users to contribute heritage pictures and metadata through competition among users. Users were awarded points for each contribution made. A leaderboard ranked users according to their scores. The application also made it possible to search and browse pictures by tags and to view pictures and metadata in a picture gallery. Contributions of pictures made through the application were stored in Amazon Simple Storage Service buckets. User information, picture information and tags were stored in a MySQL database. The application was evaluated through a survey where participants completed a list of tasks using the application and then answered questions based on their experiences. The results of the survey showed that participants had a positive user experience. Participants felt competitive enough to contribute pictures, metadata and tags and were willing to suggest the application to their friends. The application was successful at collecting heritage data as well as labelling the data with metadata and tags.

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GLOSSARY OF TERMS

Digital Object: Any digital document or file containing, for example, text, music, a picture or a video.

Metadata: Information about a digital object. For example, date created, size, author or file type.

Digital Library: Collections of digital objects and their metadata with tools and services to search, browse, edit and add objects amongst others.

Heritage: An object, quality or property, for example, a cultural tradition, countryside, historic building or family heirloom that is passed down or inherited from previous generations. Objects which may not be considered heritage at present may be considered heritage by future generations.

Heritage Data: A digital object, either born digital or digitized, that is related to heritage.

Heritage Collections: A library or archive, which may be digital, containing heritage or heritage data.

Introduction

"Much that once was is lost, for none now live who remember it."

(The Lord of the Rings: The Fellowship of the Ring, 2001)

Globalisation and industry often have a destructive effect on heritage. It is not always possible to protect cultures and languages from extinction or historical buildings from being destroyed. It is therefore important to create digital libraries of these items. The protection of heritage data is of critical importance (UNESCO, 2003). In collecting heritage data, mechanisms are needed to gather heritage of previous generations, archive current culture and make it possible to collect and preserve heritage in the future. However, due the resources, skills and work hours required, the collection of heritage data into digital libraries is a time-consuming and expensive process (Witten et al., 2010). Heritage collection initiatives are dependent on project funding. External grant funding is particularly critical to start up digital libraries (Greenstein & Thorin, 2002). For example, in 1997 the Andrew Mellon Foundation donated \$460000 towards strengthening the University of Natal's Campbell Collection of South African history (Andrew Mellon Foundation, 1997). In 1998, the Andrew Mellon Foundation donated a further \$375000 to the University of Natal in support of a national project in creating digital archives of South African periodicals (Andrew Mellon Foundation, 1998). However, this is not sustainable. According to Greenstein and Thorin (2002), securing this funding often requires writing up convincing grant proposals and promotional techniques as well as adding themselves to agencies' informal bidding lists and defending their positions. Although it can be complicated to build and maintain digital libraries, libraries often do not have

enough research and development staff members who are appropriately skilled (Greenstein & Thorin, 2002). Therefore, there is a need to find cost-efficient and time-efficient ways of preserving heritage (Suleman, 2008). One approach to achieve this may be to exploit social networks and the way in which people interact in order to benefit society. A social game is one which is multiplayer and usually based in a social network (Kirman et al., 2009). A game in a social network may provide a solution to avoid the cost, decrease time and increase scale of operation of heritage preservation. This can be done by exploiting the number of people who join the game and motivating them to supply and process the heritage data. This project proposes to use a Facebook application, functionally a game, for the purpose of gathering heritage pictures, useful metadata and tagging.

1.1 AIMS

The research proposes a method of creating collections of heritage-related pictures at a decreased financial and time cost and increased scale of operation. This method involves exploiting gaming on social networks, specifically Facebook, to motivate users to supply the heritage pictures and associated information e.g. metadata and tagging. This application should be able to bring in users and then motivate them to contribute.

Specifically, the research aims to address the follow questions:

- 1) **How effective is the application on a social network at building heritage collections?**
- 2) **How effective is the application on a social network at labelling, heritage collections with metadata, tagging, etc?**
- 3) **How can users be motivated to contribute to the collection?**

1.2 METHODOLOGY

This research suggests a solution to heritage collection that may be cheaper than current approaches. A Facebook application that would motivate users to contribute pictures and metadata related to heritage was created. Facebook's Graph API provided a development platform for the application, which was hosted on an Amazon Elastic Compute Cloud. The application was developed using Python and the Django Web Application Framework. The design and implementation of the application followed an iterative approach. A number of

focus groups and surveys were held in order to find the ideal functionality and motivation factors for the application. The final application allowed users to contribute pictures and view pictures either in the total collection, contributed by users or tagged with a particular key word. Users could also add metadata to the pictures they contributed as well as tags to pictures that they or other users contributed. A tag cloud and search box were implemented, which allowed users to browse and search through tags. With the user's permission, the application would make posts to the user's wall when the user contributed new pictures. Users were motivated to contribute by a leaderboard, which listed users by their rank. Users could improve their rank on the leaderboard by contributing pictures, metadata (picture information) or tags. The final application was evaluated through a survey, which was conducted using LimeSurvey. The aim of the evaluation process was to find out whether the application could bring in users and motivate them to contribute heritage pictures as well as metadata. The participants were asked to add the application, follow a task list and then complete the survey. The application was rated by participants of the survey in terms of user experience and competition within the application. The database statistics also provided information on the actual usage of the application.

1.3 THESIS ORGANISATION

Chapter 2 discusses current digital library systems as well as crowdsourcing approaches and games that were created for purposes other than entertainment. **Chapter 3** introduces Facebook as a development platform as well as explains Django's Model-View-Controller design pattern. The chapter also introduces two services provided by Amazon Web Services that were used in the implementation stage, namely: Elastic Compute Cloud and Simple Storage Service. **Chapter 4** provides details on the iterative design and implementation of the application. **Chapter 5** discusses the results of the evaluation of the application. Answers to the research questions, key contributions, significance and suggestions for possible future work are provided in **Chapter 6**.

Background and Related Work

Heritage data, collected and labelled by archivists, is most commonly stored in and accessed through digital libraries systems. This chapter discusses current digital library systems, specifically, but not limited to, those used for collecting heritage data. The solution proposed by this research involves crowdsourcing in a serious, social network game. For this reason, motivation factors, as well as successful crowdsourcing initiatives, will be discussed in detail. This chapter also looks at current social networks, current research in social and serious games, gamification as well as games that make use of crowdsourcing.

2.1 DIGITAL LIBRARY SYSTEMS

There are many definitions of a digital library. However, according to Witten et al. (2010), a digital library is a collection of digital objects as well as tools required to access, retrieve, select, organise and maintain the collection. Some examples of digital libraries and their services will be discussed.

2.1.1 Ready-To-Use Toolkits

Organisations, libraries, institutions and even individuals interested in building their own digital libraries need not create their own software but can choose from a variety of systems available, designed especially for building repository systems. Examples of such toolkits are:

- Invenio, originally developed at CERN (European Council for Nuclear Research) to run the CERN document server, provides a framework

and tools necessary for building and managing an autonomous digital library server (Pepe et al., 2005). Compliance to an established modular architecture is enforced, which allows for a high degree of customisation. All modules have specific and defined functionality. The software is written almost entirely in Python and uses a MySQL database server.

- DSpace, developed by MIT Libraries and Hewlett-Packard, has a three-layered architecture, namely storage, business and application (Smith et al., 2003). Storage is managed by PostgreSQL database tables and is implemented using the file system. DSpace-specific functionality is in the business layer. The business layer includes the workflow, content management, administration and search and browse modules. Functions may be replaced or enhanced as desired using module APIs. The interfaces to the system are found in the application layer, specifically the Web UI, batch loader, OAI support and Handle server.
- Fedora is a digital content repository system that provides a framework for storing, managing and disseminating complex digital objects as well as the relationships among them (Lagoze et al., 2006). The architecture is extensible and flexible, allowing for the management of rich multimedia objects. Unlike other complex object systems, the Fedora architecture includes only a Web interface and services for managing digital objects. Fedora does not provide a user interface. For this reason Fedora was used as a foundation layer in other multi-layered systems.
- Greenstone is a product of the New Zealand Digital Library Project at the University of Waikato (Witten & Bainbridge, 2007). There are two interactive interfaces, namely Reader and Librarian. The Reader interface is used by the end-user to access the digital library through a Web browser. The Librarian interface, used by the archivist, supports collecting material, adding metadata, designing search and browse functions as well as building and serving the collection.

Despite the availability of digital library software toolkits, some choose to create their own repository software (Disa, 2010) (Europeana, 2012) (Amato et al., 2006). It is also possible to build a digital library system without databases (Suleman, 2007). XML-centric solutions have many advantages over database-centric solutions. For example, insertion and retrieval functions are efficient and a well established, standardised query language already exists (Suleman, 2007).

2.1.2 Services Offered

Opinion might vary on which services are important in a digital library. For example, a user of an online music store wants to find and download music with ease. For the artists and production companies creating this music, the most important service is the protection of intellectual property and the ability to sell their products through the system. The archivist in charge of the music collection may be concerned with the ease of adding to the collection, interoperability and preservation of the collection. Digital library systems can offer different features to different types of users, for example registered or non-registered users, regular users, administrative users or contributors. Digital library systems may offer some of the following services:

- Search and browse services are offered by most digital libraries.
- Filtering, login, help and exhibits are identified as other core services (Lagoze et al., 2002).
- Aluka provides additional features such as organising, annotating, viewing and tagging content (Aluka, 2010).
- Copyright protection in respect of intellectual property rights is, in particular for contributors, a critical service for digital library systems (Marmor, 2003) (Tsolis et al., 2001).
- Europeana's ingestion mechanism ensures persistent resolvable URIs on each ingested object, allowing them to be included into Wikipedia, Google Scholar or Facebook (Concordia et al., 2010).
- Europeana, which aims to provide pan-European access to cultural heritage objects, plans to provide cross-lingual services in future releases of the Europeana API such as query and metadata translation as well as language dependent spelling (Concordia et al., 2010).

The services offered by a digital library system might be dependent on the purpose of the system or the type of data it contains. For example:

- It is common for online video services such as Youtube to allow users to post videos, comment, share and rate as well as post response videos and create playlists (Cesar et al., 2008).
- Milos, a multimedia digital library identified necessary functions as uploading, managing and sharing photographs and making photographs publicly available (Amato et al., 2006). This means that

the application must support distributed storage and classification of photographs, description of photographs with metadata, search based on metadata, management of personal folders and controlled access management (Amato et al., 2006). Many of these services are also provided by Flickr, Picasa, Snapfish and even Facebook.

- Geotagging/geocoding may be useful or even necessary to specific digital library systems (Chen & Nottveit, 2010) (Springer et al., 2008). Possible services that can be used to offer geocoding functionality include Yahoo! API Geocoder, Map24 AJAX API, Multimap Open API, MapQuest API, ViaMichelin Maps & Drive API, Google Maps Geocoding Web Service, Google Maps Javascript Geocoder, Open Geocoding, GeoPy, GeoNames Search WebService and Where 2 Get It (Chen & Nottveit, 2010).
- A recommendation service, based on the users' current or past choices, is offered by digital library systems such as Netflix (see Section 2.2.1 on the Netflix Prize), iTunes, Amazon.com and IMDB. Recommendations may also be made based on mood, style and genre derived from tags (Bischoff et al., 2009).

2.1.3 Collection of Data

A digital library expands when data is contributed to the collection. Depending on the purpose of the digital library and the type of data it stores, the data collection process may vary. For example, submission may be open to the general public, to a small specified community, to an individual, to an archivist or perhaps not open for submission at all. Submissions may or may not need to be approved before being accepted into the collection.

Submission to digital libraries may be made digitally or may be scanned from older non-digital formats. Google Books grows their collection using both approaches. Authors or publishers can submit digital books to the collection (Google Books, 2011). On the other hand, when libraries choose to contribute very old and delicate books to Google Books, Google scans in the libraries' titles with a special scanner (Vise, 2008). The scanner was developed by Google in order to not damage the books (Vise, 2008). Another example where different formats are accepted for submission to digital libraries systems is the collection of Electronic Theses and Dissertations (ETDs). Depending on the university, students may submit ETDs on a CD-ROM, to be added to the collection by an archivist, or added directly by the student through a network (Fox et al., 1999).

Publishers or contributors who are interested in providing content to digital library systems, such as JSTOR or Europeana, must first submit the journals or collections for consideration. Only contributions that meet the requirements of the digital library will be accepted. On the other hand, Wikipedia¹ is open to anyone for contribution. Contributed information is immediately added to Wikipedia without evaluation. However other contributors may report, reverse or edit information that does not meet Wikipedia policies and guidelines. Submission may take place within communities or subsections of a digital library system, for example departments within a university (Smith et al., 2003). Another example is Flickr Groups, that allow users to join groups in which to share content. Users join groups with similar interests. Groups are either private, which are not listed and where users join by invitation only, or public. Depending on the settings, some public groups can be joined by anyone whereas others require an invitation. Private collections that are owned by individuals, for example private picture collections using Picasa or Flickr, are closed to the public for contribution. The collection can only expand when the owner of the collection adds content. Some digital libraries are already complete or only allow submission by administrators. For example, the Digital Bleek and Lloyd Collection², NASA's JSC Digital Image Collection³ and digital catalogues of university or public libraries do not usually allow public submission.

2.1.4 Intellectual Property and Access

Like a physical library, a digital library is not meant to contain data in a vacuum, but to serve the public, a community or an individual by allowing access to its contents. Once again, depending on the purpose and type of data stored in the digital library, there may be variations in the way data is accessed as well as the implications of access.

In making content accessible to users, intellectual property becomes an important issue (Tsolis et al., 2001). The Google Books project highlights the degree of importance of this issue. Google Books is diverse, with titles in any and every genre, published all over the world and in time periods varying from antique to current. In addition, users are accessing Google Books from all over the world, from countries that have differing copyright laws. This complex situation has led to much debate as to whether or not Google Books' policies are fair (Grimmelmann, 2009). For this reason, on 20 September 2005, the Authors Guild, the Association of American Publishers and

¹ <http://en.wikipedia.org>

² <http://lloydbleekcollection.cs.uct.ac.za/>

³ <http://images.jsc.nasa.gov/>

individual authors and publishers filed a lawsuit against Google Books (Grimmelmann, 2009). An agreement was reached that aimed to protect intellectual property while benefiting readers and researchers and enabling copyright owners to distribute their content (Grimmelmann, 2009).

In the interest of copyright protection and respect of intellectual property, content in digital library systems is very often not available for free to the public. Some repositories are only accessible to subscribers. For example, Rhapsody4 is an online music subscription service that charges \$10 (USD) per month for unlimited access to their music collection. Most of JSTOR's content is accessible only to users logged in through their university, library or institution, who have purchased subscriptions (JSTOR, 2011). Individuals who do not belong to an institution with a JSTOR subscription may be able to obtain subscriptions through publishers (JSTOR, 2011). It is also possible for individuals to purchase certain articles from the publishers. The Institute of Electrical and Electronics Engineers (IEEE)⁵, the Association for Computing Machinery (ACM)⁶ and other publishers also make their collections available either by subscription or sale of individual works.

Aluka, an initiative to build a digital library of scholarly resources from Africa, is accessible at no charge to educational and cultural institutions in Africa (Aluka, 2010). However, outside of Africa, institutions are charged a fee scaled to the size of the organization (Guthrie & Nygren, 2007). Project Gutenberg⁷ provides electronic, public domain books freely to the public.

2.1.5 Promoting Submission

As mentioned previously, a digital library expands when new content is added. These additions may be submissions made by the public or by a community. In such cases, unless there is motivation to submit, a digital library may stagnate.

For example, the DSpace installation at Cornell University was found to be under-populated and not well used by faculty (Davis & Connolly, 2007). It was found that faculty members did not have the knowledge or the motivation to contribute to the DSpace installation (Davis & Connolly, 2007). Faculty members stated that steep learning curves, confusion with copyright, fear of plagiarism, fear of risk to reputation and concerns that posting a manuscript constitutes publishing, among others, were reasons for not contributing to the repository (Davis & Connolly, 2007). Palmer et al. (2009) suggests that

⁴ <http://www.rhapsody.com>

⁵ <http://www.ieee.org>

⁶ <http://www.acm.org/>

⁷ <http://www.gutenberg.org/>

librarians are in favour of extending traditional library activities to educating faculty about open access.

In 1996 Virginia Tech publicized that students would be able to submit ETDs electronically (Fox et al., 1999). As an incentive, the library would waive archiving fees to students submitting PDF versions instead of paper. However, in 1997 submission of ETDs became mandatory. As the total number of submitted ETDs rose from 66 in 1996 to 691 in 1997, it was clear that mandatory submission was much more effective than voluntary submission by students.

The popularity or size of a collection may be incentive enough for others to contribute. For example, once Aluka's African Plants Initiative reached a certain critical mass of content, it began to attract attention from other collection owners who decided to include their collection on the Aluka platform (Guthrie & Nygren, 2007).

Making submission easier may help to promote submission. DSpace is designed to make submission and participation by contributors easy (Smith et al., 2003). This is achieved by building the information model around the idea of organisational communities (Smith et al., 2003). For example, at MIT, the communities are schools, departments, labs and centres. Each community can choose and manage a submission process that meets its particular needs (Smith et al., 2003).

Collection owners who are not interested or able to set up and preserve their own digital repositories may choose to contribute their collections to a bigger digital library system. Offering a preservation service relieves the institution of the responsibility and cost of managing and preserving their collection (Aluka, 2010). Google Books promotes submission of old books by libraries by giving them digital copies of every book scanned (Google Books, 2011). Europeana claims that by contributing to their repository, institutions make their collections more visible, increase traffic to their websites and expose their deep-Web content to search engines (Concordia et al., 2010) (Europeana, 2012). Owners of content may also be motivated to contribute to a digital library, which promotes the sale of their products, for example Google Books (Google Books, 2011).

Digital libraries are useful systems for collecting and managing digital objects. For the purpose of this research a toolkit was unnecessary, as a simple database was sufficient. Digital library services such as browse, search, view, contribute and tag were deemed necessary for a heritage collection grown by user contributions.

2.2 CROWDSOURCING

Crowdsourcing is to invite the public or community as a whole to perform a task. It is a useful way of decreasing costs, decreasing the time taken to achieve goals, engaging communities and improving quality and value of data (Holley, 2010).

Many people attempt to harness crowdsourcing numbers with motivations of monetary pay (Hulme, 2011). Rogstadius et al. (2011) used the Amazon Mechanical Turk platform to experiment with intrinsic and extrinsic motivations of participants taking part in crowdsourcing. Although monetary payment did lead to higher recruitment numbers, it did not result in higher quality work output (Rogstadius et al., 2011). However, there are a number of motivating factors that would lead people to participate in crowdsourcing initiatives, for example money/prizes, community, sense of purpose and recognition (Hulme, 2011). Successful examples of how these motivating factors have been used in the crowdsourcing context will be discussed. Some examples may be placed in more than one of these categories.

2.2.1 Money/Prizes

Amazon Mechanical Turk, a service offered by Amazon Web Services, is a crowdsourcing marketplace (Amazon MTurk, 2011). Businesses and developers or 'requestors' have access to a scalable on-demand workforce of individuals or 'workers' (Amazon MTurk, 2011). Requestors create human intelligence tasks (HITs), which are usually tasks that cannot be performed by computers (Ross et al., 2010). The requestor offers a payment for each completed task - usually a few cents (USD) per task (Rogstadius et al., 2011). Tasks created are usually small 'micro-tasks' and include image tagging and classification, audio transcribing and various types of surveys (Rogstadius et al., 2011). As of 08:50 (UTC) on 25 November 2011, Amazon Mechanical Turk listed 247,872 HITs (Amazon MTurk, 2011). The workers are able to choose which tasks to perform as well as their own working hours (Amazon MTurk, 2011). A study of demographics found that, in 2009, workers were usually from the US or India, between the ages 18 and 25 (Ross et al., 2010). Kittur et al. warn that special care must be taken to design tasks, especially in cases where responses are subjective or qualitative (Kittur et al., 2008).

The Netflix Prize was an open competition held by Netflix (Netflix, 2009). The purpose of the competition was to find the best recommendation system algorithm for predicting user ratings on movies (Zhou et al., 2008) (Bell & Koren, 2007). The competition was based on a training set of more than 100

million ratings given by over 480,000 users to 17,700 movies (Zhou et al., 2008). Netflix offered a grand prize of \$1,000,000 (USD) and progress prizes of \$50,000 (USD) (Netflix, 2009). There were over 50,000 contestants from 186 countries (Netflix, 2009). The grand prize was won in September 2009, nearly three years after the competition began (Netflix, 2009).

2.2.2 Community

On 14 January 2011 calls for Egyptian demonstrations began to spread over Facebook and Twitter (Attia et al., 2011). Over 90,000 Facebook users confirmed their participation, which led to tens of thousands of Egyptians protesting on 25 January 2011. The large turnout motivated further calls for demonstrations through social networks. By 28 January 2011, only 14 days after the initial call for demonstrations, 1-2 million people demonstrated across Egypt. By 2 February 2011, the protestors totalled around 4-5 million people. Egypt Revolution 2.0 achieved its objectives after only 18 days. This example is a clear indication of how powerful a call for participation within a community can be. This call for participation was an invitation to a community to help achieve a goal more effectively and efficiently than was possible by individuals and therefore meets the definition of crowdsourcing.

Crowdsourcing has also been used to involve communities during disasters. There were a number of crowdsourcing initiatives deployed during the aftermath of the Haiti earthquake of 2010 (Starbird, 2011). For example, "Tweak the Tweet", a crowdsourcing initiative on the Twitter platform, was used to provide information and connect ad hoc relief groups during the disaster. Another example, Ushahidi's crowdmap⁸, was used by individuals to send SMS reports of trapped persons, needs for medical attention, etc (Starbird, 2011).

2.2.3 Purpose

Wikipedia (Wikipedia, 2011) is a collaboratively written, Web-based, free-content encyclopaedia with articles in over 50 languages. Wikipedia articles are written by anonymous Internet volunteers without pay (Wikipedia, 2011). It is therefore surprising that English Wikipedia alone has 3,806,423 articles, 25,589,707 pages in total and 15,765,995 registered users⁹. Similarly, PlanetMath¹⁰ is a web-based mathematics encyclopaedia. Entries are collaboratively written and reviewed by members of the mathematics

⁸ <http://haiti.ushahidi.com>

⁹ As of 14:05 (UTC) on 25 November 2011 (Wikipedia, 2011)

¹⁰ <http://planetmath.org>

community. Contributors to Wikipedia and PlanetMath are not paid and, in the case of Wikipedia, anonymous. Their participation can be therefore be attributed to a desire for a sense of purpose.

2.2.4 Recognition

OpenIDEO is a creative platform for thinkers around the world to discuss and collaborate in solving important social problems. At the time of writing, OpenIDEO had 22,271 users, 10 completed challenges and 2 challenges still in progress (OpenIDEO, 2011). A 'Design Quotient' is calculated for all participants of OpenIDEO, measuring the participants' contributions and activity in terms of the inspiration, 'concepting', and evaluation phases of a challenge as well as the users' collaboration with other users (OpenIDEO, 2011). The Design Quotient is like a badge of honour and although it is optional for participants to share their Design Quotient publicly with other users, most participants choose to share it (Hulme, 2011). Many have started including their Design Quotient into college applications or on their curriculum vitae (Hulme, 2011).

2.2.5 Necessity

reCAPTCHA offers a free "anti-bot" service where users identify themselves as human by recognizing distorted text, a task that is not easily achieved by a computer program. In doing so, these users are in fact helping to digitise books by recognising words that could not be deciphered by OCR (reCAPTCHA, 2010). Figure 2.1 shows an example of a reCAPTCHA box. Each box contains two words ("orbiting" and "kind" in this example). One of these words is already known and is used for the "anti-bot" service. The other word is an unrecognised word waiting to be digitised. Online services requiring the "anti-bot" service will not let users proceed without first proving themselves as human. Therefore users participate out of necessity.



FIGURE 2.1: EXAMPLE OF A RECAPTCHA BOX

2.3 SOCIAL NETWORK SITES

Social network sites are defined by Boyd and Ellison (2007) as services on the Web which, to varying degrees, allow users to:

- 1) Create a profile within a bounded system.
- 2) Specify other users with whom they share a connection.
- 3) View the list of their connections as well as other users' connections within the system.

An individual is limited to a small number of face to face interactions. However, online social networks make it possible for individuals to connect, and share information with a much larger number of individuals in a short period of time (Mayer, 2009).

Popular examples of social network sites include Facebook¹¹, Twitter¹² and Myspace¹³. There are also many social network sites that target specific communities or interest groups. Ravelry¹⁴, for example, is for those interested in knitting and crochet while Flickr¹⁵ is for sharing photographs. However, the social network with the largest user base is Facebook, with 483 million daily active users on average in December 2011 (Facebook, 2012a).

2.4 GAMES – SOCIAL AND SERIOUS

Games can be used for primary purposes other than entertainment. This research proposes a social network game to motivate users to contribute heritage data. It is therefore interesting to discuss what motivates users to play games on social networks as well as how games have been used for education, heritage preservation and completing tasks.

2.4.1 Social Network Games

Social Network Games are defined by Shin and Shin (2011) as structured, multiplayer games with rules permitting user engagement. They are casual, turn based or/and set on a social platform. Users do not play alone nor is there a cost to download the game, as is often the case with casual games (Shin & Shin, 2011). Through their survey based on social cognitive theory applied to

¹¹ <https://www.facebook.com>

¹² <http://www.twitter.com>

¹³ <http://www.myspace.com>

¹⁴ <https://www.ravelry.com>

¹⁵ <http://www.flickr.com>

uses and gratifications, Yvette Wohn et al. (2010) discovered that people are motivated to play social network games in order to build common ground, reciprocate, cope and pass time. The common ground that people played social network games for was aimed at future interaction as opposed to seeking direct social interaction (Yvette Wohn et al., 2010). Reference is made by Järvinen (2009a) to work by Yochai Benkler (2006) that identifies the motivations for social media use as social connectedness, psychological well-being, gratification and material gain. Järvinen (2009a) also refer to work by Kollock (1999) that defines motivations for contributing in online communities as reciprocity, reputation, increased sense of efficacy and attachment to and need of a group. These motivations, when addressed in terms of playing social network games can also be leverage for increasing well-being and sense of efficacy (Järvinen, 2009a). Developing games for social networks involves not only creating the rules and dynamics of the games, but also how the game is embedded into the social network, its constraints and possibilities as well as user motivations and behaviours (Järvinen, 2009b).

One of the giants in social network games is Zynga with over 60 million daily active users (Zynga, 2011). Zynga's most popular game – Farmville – was rated the #1 game on Facebook (based on daily average users) between August 2009 and December 2010 (Zynga, 2011). Zynga claims that games that encourage player engagement with other players are the best. They feed the imagination and bring joy which is lost in the daily grind (Zynga, 2011). Other popular Zynga games include MafiaWars and CityVille. According to Sung et al. (2010), social network games are designed to be easy and should not need complicated strategies or skills sets. This is perhaps what makes Farmville popular as the game mechanics are repetitive and easy to master (Sung et al., 2010). However, Ossmann & Miesenberge (2010) find fault in the design of Farmville. They claim that although Facebook itself is accessible to people with disabilities, Farmville is not. This is largely due to its use of Flash as well as relying heavily on the use of the mouse and not allowing use of the keyboard.

2.4.2 Serious Games

A serious game may be entertaining; however the primary focus is on education and training (Allen et al., 2009). Serious games have been created for heritage preservation and education by allowing players to explore and interact with heritage data (Djaouti et al., 2009) (Mikovec et al., 2009) (Zara, 2004). Virtual environment games are implemented to allow users to explore historical and cultural sites (Mikovec et al., 2009) (Zara, 2004). A serious game was created that educated users about the Gangas Caves located in France

(Djaouti et al., 2009). Serious games have also been used to teach personal fire safety skills (Chittaro & Ranon, 2009). ‘Foldit’, a multiplayer online game, enlisted players worldwide to solve difficult protein-structure prediction problems, which provided new insight for the design of antiretroviral drugs (Khatib et al., 2011).

2.4.3 Gamification

As with serious games, games can be used for purposes other than entertainment (Deterding et al., 2011b). Gamification can be defined as using game design elements in non-game contexts (Deterding et al., 2011b) or, more specifically, improving user experience and user engagement, by incorporating video game elements into non-gaming systems (Deterding et al., 2011a). A categorization of gamification techniques based on existing literature has been made by Deterding et al. (2011b), namely: 1) interface design patterns (such as badges, levels, or leaderboards), 2) game design patterns or game mechanics, 3) design principles or heuristics, 4) conceptual models of game design units and 5) game design methods. Awarding badges is one of the key gamification techniques and has become standard practice in online social media (Antin & Churchill, 2011). Five primary functions of badges in gamification are identified in Antin & Churchill (2011), namely: goal setting, instruction, reputation, status affirmation and group identification.

2.4.4 Games for Crowdsourcing

It is possible to achieve a crowdsourcing effect by creating a serious game that motivates players to perform the required task.

The ESP game (von Ahn & Dabbish, 2004) has motivated players to produce millions of labels for images on the Web without even realising they are doing so. Players are paired up and shown the same image. The players then have to “guess” what the other player is thinking. In order to achieve this both players provide words describing the picture in front of them. Certain words are identified as “taboo”. These words have already been accepted as labels of the image and cannot be used as guesses. When both players have provided the same word, it is taken as a possible label for the picture and the players receive points. The same picture will be shown to many pairs of players so that the system can ensure that labels are relevant to the image. Similarly Google also has used this approach and crowdsourcing to involve the public in labelling images¹⁶.

¹⁶ <http://images.google.com/imagelabeler/>

The game Peekaboom (von Ahn et al., 2006) had players locating objects in images and categorising labels as nouns, verbs, related nouns or text in the image. The game consists of two players: 'Peek' and 'Boom'. 'Boom' is shown an image and a related word. "Boom" reveals a small part of the image so that 'Peek' can guess the word. If 'Peek' correctly guesses a word, both players receive points and then switch places.

The Gopher Game is a social game where players supply content by uploading and sharing photos as proof of completion of tasks within the game (Casey et al., 2007).

Sigtific Lab (Sigtific Lab, 2010) was developed by the Institute for the Future, a non-profit futures-research group. Sigtific is a public research project where scientists, engineers, designers, developers, researchers, technologists and creative thinkers are invited to help make forecasts about the future of science and technology. The project is presented in the form of a game. Players are shown a short video of a possible future scenario. The players then make "micro-forecasts". These can be optimistic or pessimistic. Players can then make forecasts on top of other player's forecasts by disagreeing, taking the forecast further, adapting the forecast or asking questions. All forecasts are added to a public database that can be freely accessed by the public under a Creative Commons Attribution-Noncommercial-Share Alike licence.

These games managed to achieve outcomes that would otherwise have been time consuming and costly to achieve.

2.5 SUMMARY

This research proposes crowdsourcing the public through a game on a social networking site for the purpose of creating digital heritage libraries. This chapter therefore looks at related research of these seemingly disparate concepts.

Digital library systems such as DSpace, Fedora and Greenstone offer institutions and organisations the opportunity of creating their own repositories without having to build the software from scratch. However some institutions have chosen to create custom solutions to better suite their needs. A digital library is not only defined as a collection of digital objects, but the ability to manage these objects and tools to access, retrieve, select, organise and maintain the collection. Digital libraries have different types of users, for example in a digital library of scholarly resources there may be

archivists, publishers and scholars – each have different needs in terms of services offered. The type of data a digital library contains may also impact the services offered by that digital library. Digital library systems may be open for contribution by public, by specified communities, or only to the individual owner. Some digital libraries are not open to contribution at all as the collection is already complete. Copyright protection and the respect of intellectual property becomes an important and sensitive issue when allowing access to data. This usually results in access being limited to communities, individuals or subscribers. In order for a digital library to grow, new submissions must be made. However, when users are the source of new submissions, repositories may be left empty if users are not motivated to contribute. Solutions to promote submission by users include education, making submission easier, offering services or benefits to contributors or, if possible, making submission mandatory.

Crowdsourcing is one approach to create content for a repository. AmazonTurk and the Netflix Prize are examples of promoting crowdsourcing by offering monetary rewards. However, there have been many successful crowdsourced projects that did not use monetary rewards. For example, a sense of community spread the Facebook calls for Egyptian revolution. Wikipedia authors are unpaid and often anonymous; therefore their desire for a sense of purpose motivates them to contribute. The OpenIDEO project rewards contributors with recognition through a Design Quotient. reCAPTCHA ensures user participation in digitizing books by linking it to an anti-bot service.

Social network sites allow interaction of users more often than is possible face to face. Users of social network site can form communities and share ideas. Social network games, often incorporated into a social network site, are rising in popularity. For example those created by Zynga have 60 million daily active users. Serious games have had many uses, including heritage preservation, education and solving difficult protein-structure prediction problems. Games such as ESP and Peekaboom may also be used to promote crowdsourcing activities.

Technology Platforms

This chapter briefly introduces the technology platforms used during the implementation phase of this research. Specifically, Facebook provided an application platform that allowed access to a large number of users. This application was created using Python and Django's Web Framework and was hosted on an Amazon Elastic Compute Cloud instance. Additionally, Amazon Simple Storage Service was used to store the pictures collected by the application. Details on how these platforms were used can be found in Section 4.2.

3.1 FACEBOOK

With 483 million daily active users on average in December 2011, Facebook is an ideal platform for accessing users (Facebook, 2012a). The Facebook Developers application makes it possible for Facebook users to create their own applications. For these reasons, Facebook was the chosen social network for this research. This section briefly introduces the Facebook development environment.

Facebook (2012b) applications can be created by adding the Facebook Developer Application¹⁷. When an application is created, Facebook provides the developer with an Application ID (API Key) as well as an Application Secret Key, which are used for authentication purposes. The developer must then configure the application, create a canvas page and specify a canvas URL.

¹⁷ <https://developers.facebook.com/apps>

A Facebook canvas page is simply the page in which the application is loaded. A canvas page can use either Facebook Markup Language (FBML) or an IFrame.

3.1.1 Canvas Types

3.1.1.1 FBML

FBML is an HTML extension used in traditional canvas applications and rendered by Facebook directly. This can be an inefficient process as the application must wait for requests to be processed on Facebook's server, as can be seen in Figure 3.1. The user makes a request to Facebook to view the application. Facebook then makes a request to the application's server. The application may make an API call to Facebook in order to access user information. The application then sends the FBML response back to Facebook, which converts the FBML into HTML and sends the result to the user. Facebook has now deprecated FBML and as of 1 June 2012 all FBML applications will no longer work.

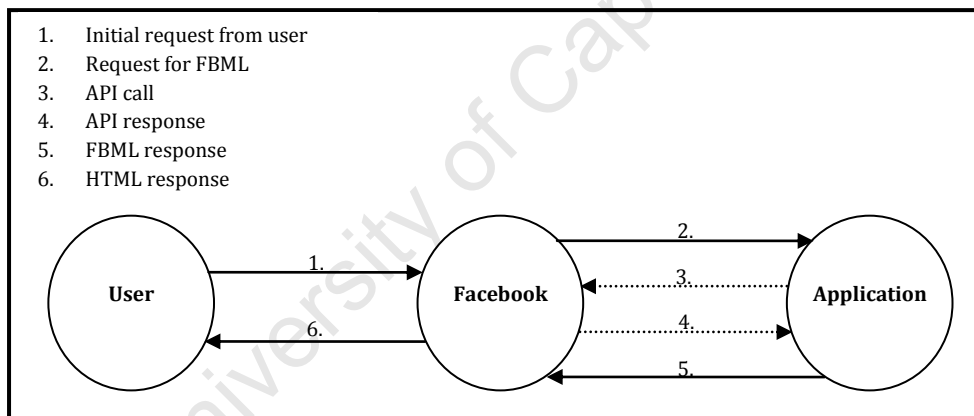


FIGURE 3.1: FBML CANVAS APPLICATION

3.1.1.2 IFrame

IFrame applications are rendered by the developer's server and therefore can be more efficient than FBML. As can be seen in Figure 3.2, the user makes a request to Facebook to view the application. Facebook sends the user an IFrame surrounded by a Facebook border, with the Facebook toolbar above the application and adverts on the right. The user then makes a request to the application server to view the IFrame. The application may make an API call to Facebook in order to access user information. The application server then sends the IFrame directly to the user. The IFrame is therefore more efficient than FBML and for this reason was used in this research.

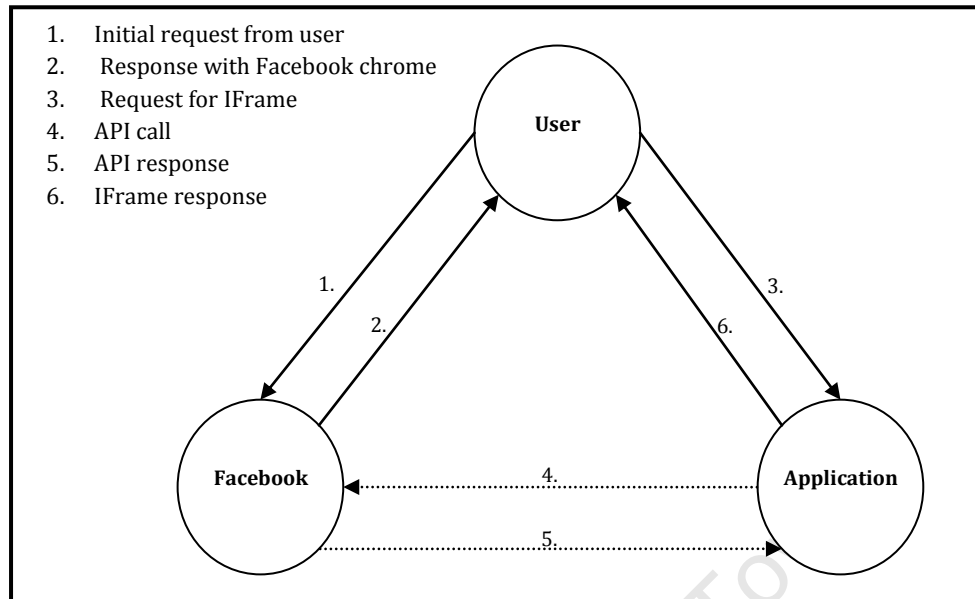


FIGURE 3.2: IFRAME CANVAS APPLICATION

3.1.2 APIs

Facebook's API options have changed often and dramatically over the time span of this research. For example, FBML has been deprecated and the REST API is in the process of being deprecated. Many application development options that are currently (at the time of writing) available were not available during either the research or development phase of this work. For this reason, only API and development options that were available at the time and are still in use will be discussed.

3.1.2.1 Graph API

In Facebook's social graph, the objects are people, photographs, events and pages. The connections among these objects are friendships, likes and photograph tags. The Graph API provides a simple and consistent view of this social graph by representing these objects and connections. Each object has a unique ID, which can be used in simple URL queries to access information on that object. For example, Coca-Cola's page has a Facebook ID of 40796308305. Using this ID, the following request can be made:

`https://graph.facebook.com/40796308305`

The responses sent back are JavaScript Object Notation (JSON) objects¹⁸. The response to this particular query can be seen in Figure 3.3. The information provided is only that which is publicly available. In order to access further

¹⁸ <http://www.json.org/>

information, one would need an access token, which is available only with authorisation. For this, the Graph API uses OAuth2.0¹⁹. The details on how this authorisation was implemented are described in Section 4.2.2.

```
{
  "id": "40796308305",
  "name": "Coca-Cola",
  "picture": "http://profile.ak.fbcdn.net/hprofile-ak-snc4/162066_40796308305_751302705_s.jpg",
  "link": "https://www.facebook.com/coca-cola",
  "likes": 39697102,
  "category": "Food/beverages",
  "is_published": true,
  "website": "http://www.coca-cola.com",
  "username": "coca-cola",
  "founded": "1886",
  "description": "Created in 1886 in Atlanta, Georgia, by Dr. John S. Pemberton, Coca-Cola was first offered as a fountain beverage at Jacob's Pharmacy by mixing Coca-Cola syrup with carbonated water. \n\nCoca-Cola was patented in 1887, registered as a trademark in 1893 and by 1895 it was being sold in every state and territory in the United States. In 1899, The Coca-Cola Company began franchised bottling operations in the United States. \n\nCoca-Cola might owe its origins to the United States, but its popularity has made it truly universal. Today, you can find Coca-Cola in virtually every part of the world.",
  "about": "The Coca-Cola Facebook Page is a collection of your stories showing how people from around the world have helped make Coke into what it is today.",
  "location": {
    "latitude": -33.816989983333,
    "longitude": 150.84844081667
  },
  "can_post": true,
  "checkins": 78,
  "talking_about_count": 552473
}
```

FIGURE 3.3: GRAPH API RESPONSE

3.1.2.2 FQL

Facebook Query Language (FQL) is an SQL-style interface available to query the data exposed by the Graph API. Queries take the form:

```
SELECT [fields] FROM [table] WHERE [conditions]
```

Available tables include album, event, family and user. FQL provides advanced features that are not available using the Graph API. Using FQL also allows a developer to be more specific about the information required, which helps Facebook's servers to optimize requests.

¹⁹ <http://oauth.net/2/>

3.2 DJANGO

Django (Django, 2012) (Holovaty & Kaplan-Moss, 2009) is a Web framework aimed at simplifying the building of Python Web applications. Django's fundamental goals are:

- Achieving loose coupling (where modules are only as dependent as absolutely necessary) and tight cohesion (where modules are responsible for all and only their related tasks),
- Using as little code as possible,
- Creating the opportunity for quick Web development,
- Reducing redundancy,
- Being explicit rather than implicit and
- Maintaining consistency at all levels.

Django follows an MVC (Model-View-Controller) pattern in a somewhat unconventional manner. A Django “view” describes which data will be presented to the user and not how it is presented. This is where the business logic for the page is stored. The presentation logic is stored in the “templates”, which are HTML Web pages. Therefore, Django “view” and “template” combined perform the traditional role of a view. “Model” describes the database table and is where the data-access logic is stored. This is achieved using Python code rather than SQL statements. However, Django supports SQL statements when needed. Therefore Django calls this framework MTV (Model-Template-View). One could argue that the controller function is actually performed by Django's framework through the URL configuration, which specifies which view should be called for a given URL pattern.

Figure 3.4 shows the relationship between the URL configuration, the views, the models and the templates. When an URL request is made to the application, the URL configuration file `urls.py` is used to decide which view function should be called. After computation, which may involve the models, the view functions render the html files from the templates.

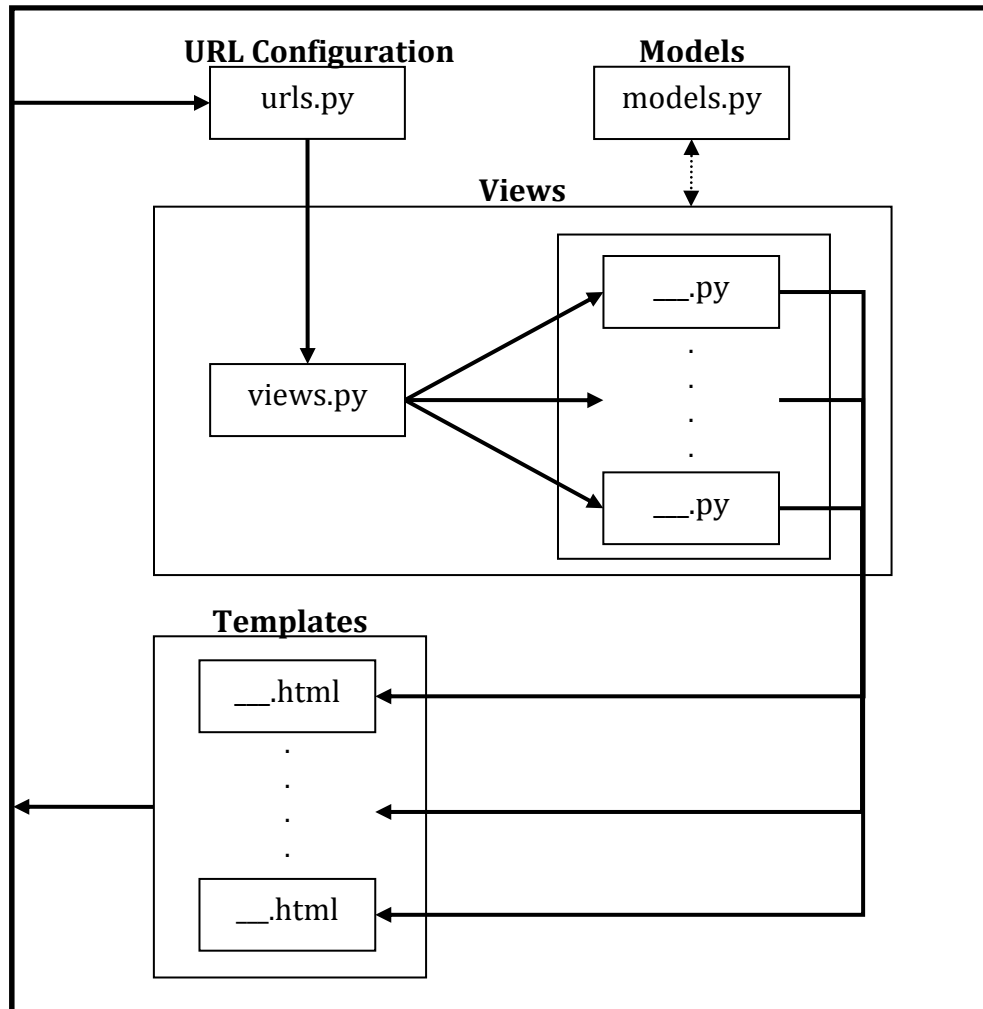


FIGURE 3.4: THE INTERACTION BETWEEN MODELS, VIEWS, TEMPLATES AND URL CONFIGURATION FILES IN A DJANGO APPLICATION

3.3 AMAZON WEB SERVICES

As mentioned, two services of Amazon Web Services were used during the development stage of this research. The application was hosted on an Amazon Elastic Compute Cloud (EC2) server instance. Amazon Simple Storage Service (S3) was used to store the pictures collected by the application.

Amazon Web Services (AWS) (AWS, 2012a) offers IT infrastructure to businesses as a Web service. The services offered are on a pay-as-you-go basis in terms of the number of servers or storage space required as well as in terms of computation time required. There are no up-front expenses or long-term commitments. Due to efficiency of scale, Amazon offers low prices. There is also a decreased risk to companies who are unsure of the scale of hardware they will need. For example, a company may not know if workload will

increase dramatically, requiring more hardware, or if workload will stay the same or even decrease. Usually, a company would have to either wait for new hardware to arrive, or possibly purchase too much hardware and carry the unnecessary expense. However, with AWS and other cloud computing service providers, a company can instantly increase or decrease its scale of operation and only pay for what it uses. AWS is not restrictive in terms of platforms, programming models or operating systems. AWS is also secure and durable, boasting many industry-recognised certifications and audits. Amazon Web Services are therefore reliable, scalable and low cost.

A number of AWS services and products are offered in the following categories: compute, content delivery, development and management, application services, networking, payments and billing, storage, support, Web traffic and workforce (see Section 2.2.1 on Amazon Mechanical Turk). In this section, only the two services used for this research will be discussed, namely: Amazon Elastic Compute Cloud and Amazon Simple Storage Services.

3.3.1 Elastic Compute Cloud (EC2)

Amazon Elastic Compute Cloud (EC2) provides resizable compute capacity in the cloud. Virtual computer instances are easily and instantly launched or terminated. Therefore, capacity can be scaled up or down when requirements change. These instances can be loaded with a variety of operating systems and software packages. With Amazon EC2 it is possible to provide protection from failure at a single location. This is achieved by creating redundancy and placing instances in multiple locations that are composed of “regions” and “availability zones”. At the time of writing the following regions were available: US East (Northern Virginia), US West (Oregon), US West (Northern California), EU (Ireland), Asia Pacific (Singapore), Asia Pacific (Tokyo) and South America (São Paulo). Geographically dispersing instances can increase security with increased redundancy. Network speeds may also be improved by choosing regions closest to where they will be used.

Amazon EC2 provides the following features: Amazon Elastic Block Store (EBS), Multiple Locations, Elastic IP Addresses, Amazon Virtual Private Cloud, Amazon CloudWatch, Auto Scaling, Elastic Load Balancing, High Performance Computing (HPC) Clusters and VM Import. In order to suit different processing and memory and requirements, different instance types are available, namely: Standard, Micro, High-Memory, High-CPU, Cluster Compute and Cluster GPU. The standard instance is suited to most applications. A Micro instance was chosen for use in this research as its specifications were sufficient. The Micro instance provides 613MB of memory, up to 2 Elastic

Compute Units (ECU), Elastic Block Store (EBS) which is storage that persists, independent of the instance, on either a 32-bit or 64-bit platform. Amazon currently offers this service free²⁰ for the first year.

3.3.2 Simple Storage Service (S3)

Amazon Simple Storage Service (S3) is a fully redundant, data storage Web service that allows developers to store and retrieve data. There is no limit to the number or type of objects that can be stored as the service is highly scalable. Objects, ranging from 1 byte to 5 terabytes each, can be written, read and deleted. The “Amazon S3 Service Level Agreement”²¹ ensures reliability. Data is stored securely across a number of data centres.

Buckets are created by the developer and data objects are stored in the buckets. The buckets are unique across developers. Objects can be made private or public. Each object is assigned a unique key for retrieval. This allows objects to be addressed with a simple URL call, for example:

`https://s3.amazonaws.com/<bucket_name>/<object_key>`

A BitTorrent protocol interface is also available for lowering costs of high scale distribution. Amazon states that by the end of 2011 there were 762 billion objects in Amazon S3, with 500,000 requests being processed per second during peak times (AWS, 2012b).

3.4 SUMMARY

This chapter introduced the technology platforms used for development in this research, namely: Facebook, Django and Amazon Web Services.

Facebook was chosen as the social network site used for the development phase of this project due to its large user base. Facebook allows developers to create applications on the Facebook platform. These applications can either use Facebook Markup Language (FBML) or an IFrame. However, IFrames are a more efficient option as users request the IFrame directly from the application server. Facebook’s Graph API provides access to Facebook’s social graph. This is achieved by making simple URL requests to Facebook, which sends a JSON object in response.

²⁰ <http://aws.amazon.com/free/>

²¹ <http://aws.amazon.com/s3-sla/>

Django is a Python Web application framework and was chosen as a development platform as it simplifies Web application development and is a recommended Python framework for building Facebook applications.

Amazon Web Services (AWS) are a reliable, scalable and low cost solution for Web application hosting. Amazon Elastic Compute Cloud (EC2) allows virtual computer instances to be launched with ease, creating instantly scalable computation capacity. Amazon Simple Storage Service (S3) provides secure, scalable storage for any amount of data of any data type and of any size. These two AWS services were used to host the application developed and to store the pictures collected.

University of Cape Town

Design and Implementation

The development process of this project involved creating a Facebook application to collect heritage data. Development was carried out using an iterative approach of design and implementation. This chapter explains the design iterations, as well as discusses the implementation details, of the final system created.

4.1 DESIGN ITERATIONS

Figure 4.1 gives an overview of the how the system was iteratively designed. A literature review was completed in April 2010. A focus group was then arranged in order to plan an initial design of the application. The initial design was then used to build the initial pilot study. At the time, Facebook had many possible API choices. It was therefore necessary to experiment with the different APIs. Experimenting with Facebook's APIs led to the production of a prototype. As the application relies on users' contributions, it was necessary to ensure that the users were motivated to contribute. For this reason three systems were created, for comparison purposes, with differing types and levels of motivation. System 1, the baseline system was built first, with no social interaction or motivation factors. System 1 was tested by volunteer Computer Science postgraduate students who were asked to use the system and then complete a survey. Another focus group was then held in order to design Systems 2 and 3, the social systems with different motivating factors. System 2 was created as a competitive system with the use of leaderboards, while System 3 was non-competitive and motivated users with badge

upgrades. Systems 2 and 3 were produced concurrently, based on results of both the survey and focus group. Systems 1, 2 and 3 were then tested and compared through a survey. Using the results from this survey, the final system functionality to promote user participation was chosen. The final system is described in detail in Section 4.2.

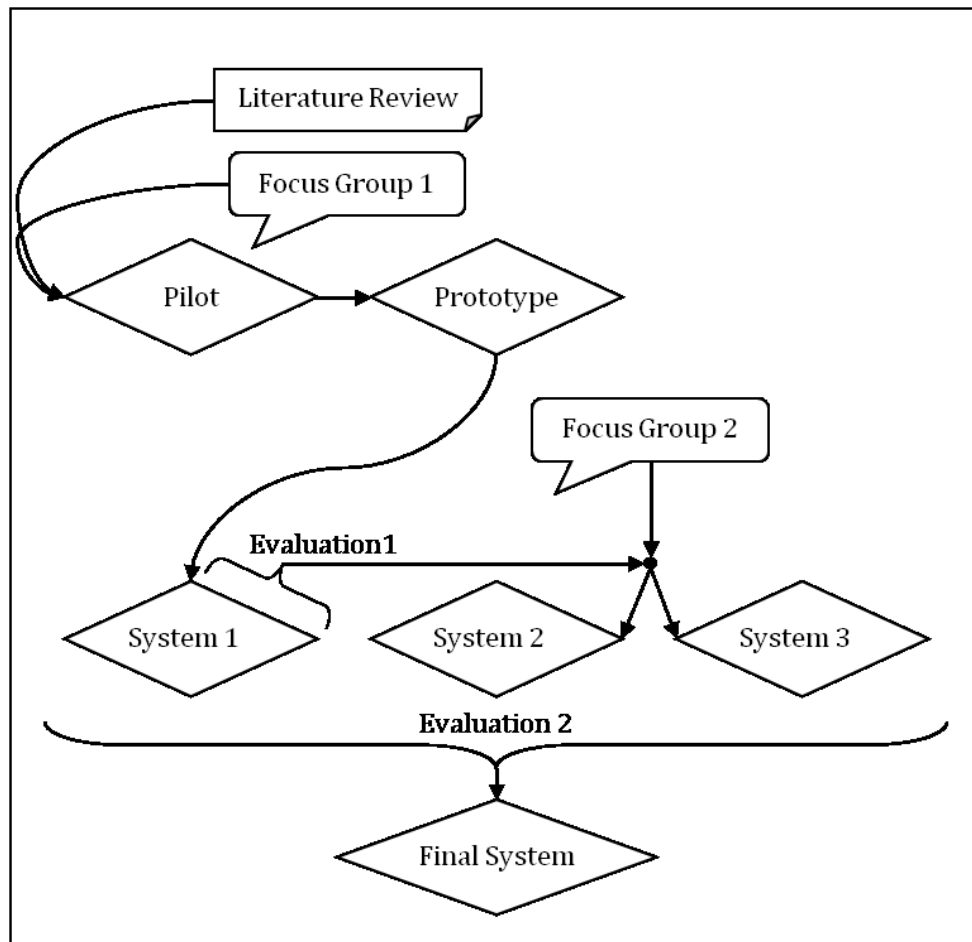


FIGURE 4.1: DESIGN ITERATION OVERVIEW

4.1.1 Focus Group 1

The intention of the initial focus group was to get ideas and opinions on how the Facebook application should be designed. Seven University of Cape Town computer science postgraduate students studying in fields related to game development and digital libraries were invited to the focus group. This was partly for convenience and partly because together they were best suited to give insight on developing a Facebook game as well as creating a digital library. The questions were broken up into four categories, namely: introductory, transition, key and ending. The purpose of separating questions into these categories is to get attendees “warmed up” and comfortable talking

before the key questions are asked (Krueger & Casey, 2009). The focus group audio was recorded with permission from all attendees. There was also a note taker present. The focus group lasted 45 minutes. The outcome of the focus group was that a simple application should be created, that should be social, easy to use and easy to compete. Participants of the focus group also stressed the importance of informing the users of the purpose of the application.

4.1.2 Pilot Study

A pilot study was carried out in order to test whether Facebook would be an appropriate platform. It was also beneficial in getting comfortable with Facebook application development. The application created allowed users to upload images to a public collection. Nine random images from the collection were displayed as can be seen in Figure 4.2. The application was written using PHP, HTML and the Facebook REST API, which was functional at the time. The pilot application was hosted on mufasa.cs.uct.ac.za.

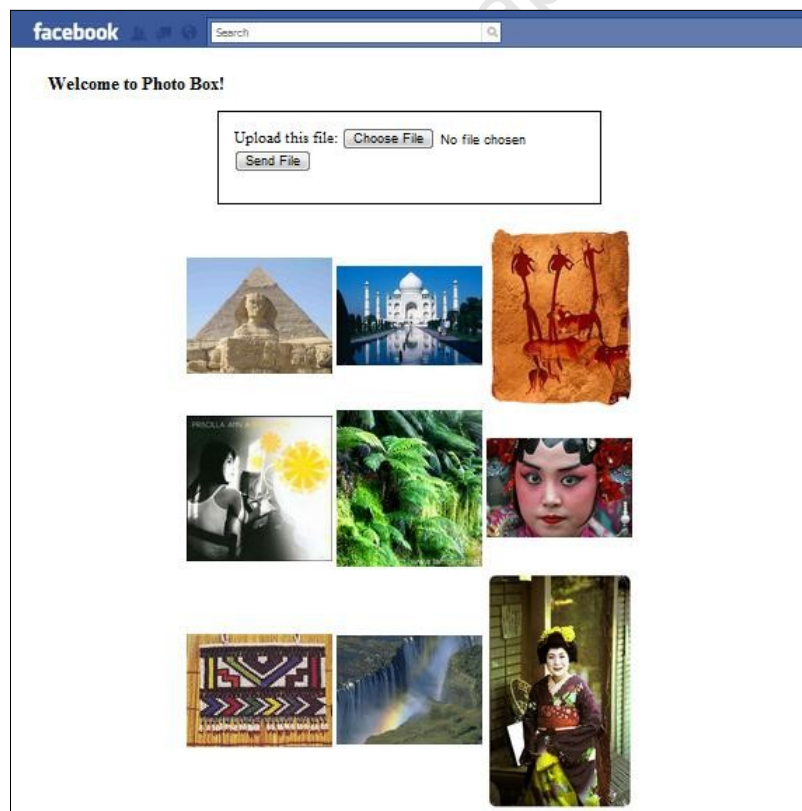


FIGURE 4.2: SCREENSHOT OF THE PILOT STUDY

4.1.3 Prototype

The prototype had more functionality than that of the pilot study system. The application allowed users to upload images to a public collection, view images in their private collection or public collection and invite friends. It was created using Python in Django, HTML, Facebook's REST API as well as XFBML (FBML for IFrames) and was hosted on mufasa.cs.uct.ac.za.

4.1.4 System 1

Three systems were built for comparison purposes in order to find ways of motivating users to contribute to the collection. System 1, the baseline system was intended to have no obvious social interaction between players and no form of competition or implicit motivation to contribute. Users could upload images, add and edit metadata, browse "my collection" and "full collection", tag images and search and browse images by tags. System 1 was created using Python in Django, HTML, JavaScript, and Facebook's Graph API and was hosted on an Amazon EC2 server.

4.1.5 Evaluation 1

The application was seeded with pictures and tags to create interest when tested by users. The purpose of the first evaluation was to test how usable the application was as well as evaluate the user experience of the application. Computer science postgraduate students at the University of Cape Town were invited to participate in this evaluation. Specifically, the students invited were researching either in the field of User Experience Design (UXD) or in the field of digital libraries. Eleven students participated, four from UXD and seven from digital libraries.

4.1.6 Focus Group 2

A second focus group was assembled out for the purpose of brainstorming how to create social interaction in the application in ways that were either competitive and/or non-competitive. There were six participants in this focus group, all computer science postgraduate students at the University of Cape Town. Half the participants also participated in the first evaluation and had experience with the application whereas the other half had never seen the application. The purpose of this mixture was to get a broader set of ideas. The participants who knew the application could share ideas based on their experience. The other participants, who had no experience with the application, would not be limited in their ideas. The participants were asked

to be creative and non-judgmental of any ideas proposed. The participants were also encouraged to build upon the ideas of others. Ideas did not have to be realistic or achievable. Before anything was discussed, the participants with no experience with the application were given a brief introduction. The focus group consisted of two discussion questions. 1) What could create competition among users of the application? 2) What could create collaboration among users of the application?

4.1.1 System 2

System 2, the social-competitive system included social interaction among users as well as a competitive atmosphere that was intended to motivate users to outperform other users. This competitive atmosphere was achieved by including a leaderboard. Users could improve their score on the leaderboard by adding pictures, adding metadata on pictures and adding tags. Users could compare their scores either to all other users or specifically to their friends. A leaderboard summary can be seen in Figure 4.15 and will be discussed in more detail in Section 4.2.4.5.

4.1.2 System 3

System 3, the social-non-competitive system included social interaction, but without a competitive atmosphere. Instead, users were motivated to upgrade their badge, thereby outperforming themselves. A silver badge is shown in Figure 4.3. Users could improve their badge by adding pictures, adding metadata on pictures and adding tags.

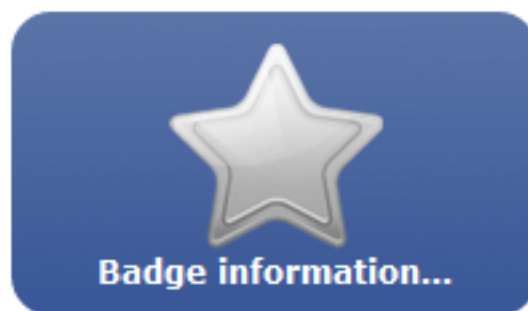


FIGURE 4.3: A SILVER BADGE FROM THE SOCIAL NON-COMPETITIVE SYSTEM

4.1.3 Evaluation 2

The three systems were tested by volunteers and compared through a survey. The outcome of the survey showed that although participants were motivated by both the leaderboard and badges, they were more motivated to contribute data in order to improve their scores on the leaderboard than to level-up their badge. For more details on this evaluation stage please see Section 5.3.1 in the Evaluation Chapter.

4.1.4 Final System

The results of the second user evaluation determined the chosen functionality for the final system, which was then made public on Facebook. The final system is shown in Figure 4.4 and discussed in detail in Section 4.2.

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4.2 IMPLEMENTATION DETAILS

The implementation details discussed in this section refer to the final system that was created. The final system is shown in Figure 4.4. First the specifications of the server that hosted the application are described. Next the application's interaction with Facebook is explained. The user interface, as well as ethical issues, are then discussed in detail.

Save My Heritage

This application forms part of research on the preservation of heritage. [More Information...](#)

Full Collection


- Full Collection
- My Collection
- Add a Picture

leaderboard

#1	Em
#2	J
#3	M
#4	F
#5	M
#6	M
#7	J
#8	J
	...





Search





aerial photography africa
angola animal beach
boat botswana
braai building
cape of good hope
cape point
cape town chewa
christmas
clifton desert
drakensberg dubai
flowers
france history holiday
ireland kirstenbosch
lighthouse
lions head luanda markets
memorial mountain
nantes nature ocean
ome
random sea shipwreck
snow
south africa stilbaai
sudan
sunset table mountain
train tree uct
western cape
zambia zimbabwe




Apple Cape Town Houtbay
Add a Tag

page 1 of 36



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FIGURE 4.4: SCREENSHOT OF THE FINAL SYSTEM

4.2.1 Server Specifications

The application server was an Amazon EC2 Micro-Instance. Virtual machines are created in Amazon EC2 with Amazon Machine Images (AMIs), which are pre-configured operating systems. The AMI chosen was amzn-ami-2010.11.1-beta.x86_64-ebs (ami-74f0061d), an Amazon Linux 64bit operating system with an image size of 8GB and 613MB of memory. The US East (Virginia) locality was selected.

Due to demand from users, Facebook allows users a secure browsing option. For this reason, Facebook requires all applications to provide a secure canvas URL as well as the usual canvas URL. However, not all Facebook users have enabled the secure browsing option. Therefore the application had to handle both SSL and non-SSL connections. Django itself does not handle SSL connections. Apache was used to reverse proxy the application to serve two ports, port 443 for SSL connections and port 80 for non SSL connections. Therefore Apache handled the SSL connections and not Django, which listened on port 8000. Security groups were set up on the Amazon EC2 instance that specified the ports and services that were open to inbound requests. These were defined as follows:

Port (Service)
22 (SSH)
80 (HTTP)
443 (HTTPS)
8080 (HTTP*)

For convenience in a development environment, port 80 and port 8080 were both open to inbound HTTP requests. Port 80, was open for the purpose of serving up the application as discussed above. Port 8080 was used by Apache to serve up PHPMyAdmin, which was used to monitor the database. Port 22 was used for requests made for static data, such as styles sheets, arrow images used in the gallery, as well as temporary storage used for image processing while the dissemination and thumbnail pictures were created as described in Section 4.2.3.

4.2.2 Facebook Details

The Facebook application is named “SaveMyHeritage” and has a canvas page <https://apps.facebook.com/heritagere/>. An IFrame canvas type was chosen over a FBML canvas type as there is a faster load time (see Section 3.1.1).

The Facebook Graph API was the chosen API option. In order to access user’s details such as a list of the user’s Facebook friends, as well as publishing to the user’s wall, it is necessary to gain authorisation from the user. The Facebook Platform uses the OAuth 2.0 protocol for authentication and authorization. This is achieved as follows. The first time a user tries to access the application, a URL request is made to Facebook:

```
https://www.facebook.com/dialog/oauth?client_id=<application_ID>&redirect_uri=
<application_URL>&scope=user_photos,user_online_presence,publish_stream
```

Where *<application_ID>* is the App ID or API key that Facebook assigned to the application and *<application_URL>* is the URL address for the application. The “scope” indicates the specific permission the application is requesting from the user. The “publish_stream” scope option is required in order to post to the user’s wall.

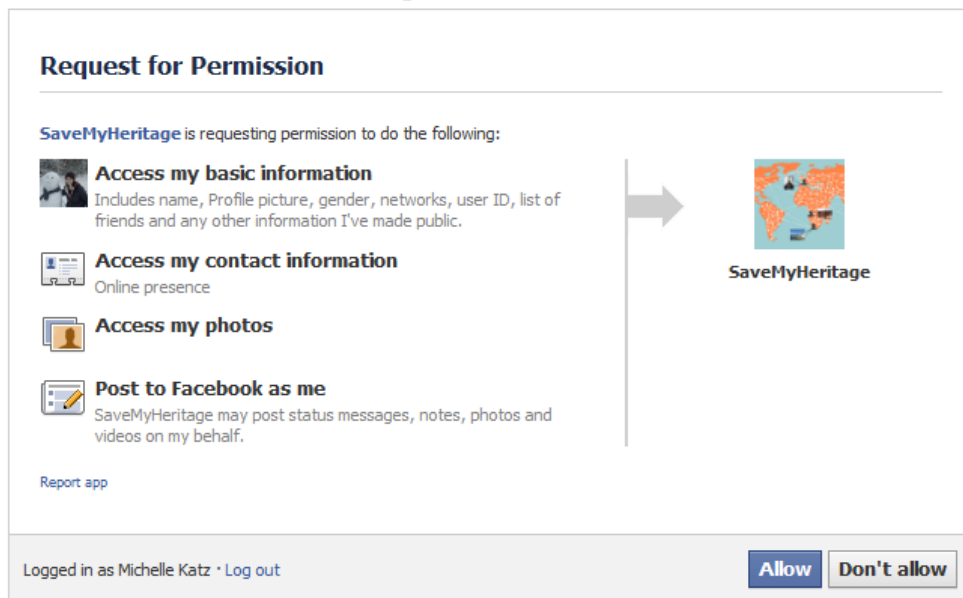


FIGURE 4.5: FACEBOOK AUTHORIZATION DIALOG

The user is then shown the dialog box in Figure 4.5. If the user chooses “Allow” the application is authorized and is sent an authorization code. The authorization code is then used to request an access token:

```
https://graph.facebook.com/oauth/access_token?
client_id=<application_ID>&redirect_uri=<application_URL>&client_secret=
<application_secretkey>&code=<auth_code>
```

The `<application_ID>` and `<application_URL>` are as above. The `<application_secretkey>` is the secret key that Facebook assigned to the application. The `<auth_code>` is the authorization code generated in the previous step. If the application is authenticated with the secret key and if the authorization code is valid, the authorization server sends an access token.

The access token is then used in requests to the Graph API. For example, the user’s friend list is required for the friend leaderboard. A URL request is made to Facebook as follows:

```
https://graph.facebook.com/<user_id>/friends?access_token=<access_token>
```

Where `<user_id>` is the user’s Facebook ID and the `<access_token>` is provided to the application by Facebook during the authentication process. The user’s friends are then sent back in a JSON object.

The Graph API is also used to publish to the user’s wall when a user adds a picture to his/her collection (see Figure 4.17). In order to post to the user’s wall, a URL request is composed as follows:

```
https://graph.facebook.com/me/feed?access_token=<access_token>&message=
<message>&picture=<thumbnail>&link=<canvas_url>
```

The `<access_token>` is provided to the application by Facebook during the authentication process. The `<message>` is the text in the post, for example “_____ has contributed a new picture toward heritage preservation!” in Figure 4.17. The `<thumbnail>` is a URL link to the picture that the user added. The `<canvas_url>` is the application’s canvas page on Facebook.

4.2.3 Data Storage

Three Amazon S3 buckets were created in order to store the pictures in the collection. The first bucket was created for archival purposes. Pictures are stored in this bucket in full quality and are not used at all by the application. The second bucket is for dissemination purposes. The original picture is stored at a reduced quality and is used by the application when displaying pictures. The quality is reduced to improve the load time of the pictures. The third bucket stores thumbnail versions of the pictures, once again to improve load time. The picture in all three buckets is identified by the same name/id. This unique id allocated to the picture is a combination of POSIX time and a random eight digit number.

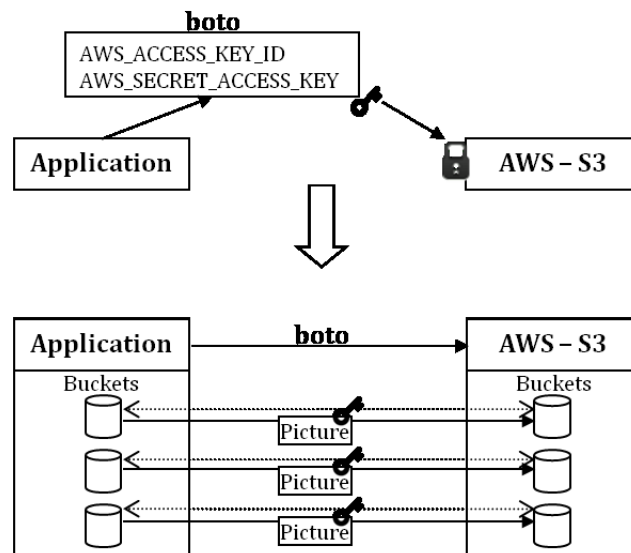


FIGURE 4.6: USING BOTO TO CONNECT TO AWS

The boto²² library for Python provided an interface to Amazon Web Services. In order to save a picture to the Amazon S3 buckets, the following steps are taken as illustrated in Figure 4.6. Firstly the `AWS_ACCESS_KEY_ID` and `AWS_SECRET_ACCESS_KEY`, located under “Security Credentials” in the AWS account, are defined. These access identifiers serve the purpose of an AWS username and password, respectively. The AWS access identifiers are then used to connect to Amazon S3 through boto. Using this connection through boto, buckets are created to match the three buckets in Amazon S3. For each bucket, a key is created with the name of the unique id of the picture. These keys are then used to add the picture as well as to set the permissions.

²² <http://readthedocs.org/docs/boto/en/latest/>

The metadata associated with the pictures are stored in a MySQL database along with user details and tags. For convenience, the picture names used in the S3 buckets are the same as those used in the database. The database is described by a django Model in a Python file, with each table being represented by a class. The database contains four tables, namely: User, Picture, ReportedPicture and Tag. The database schema, shown in Figure 4.7, is explained below.

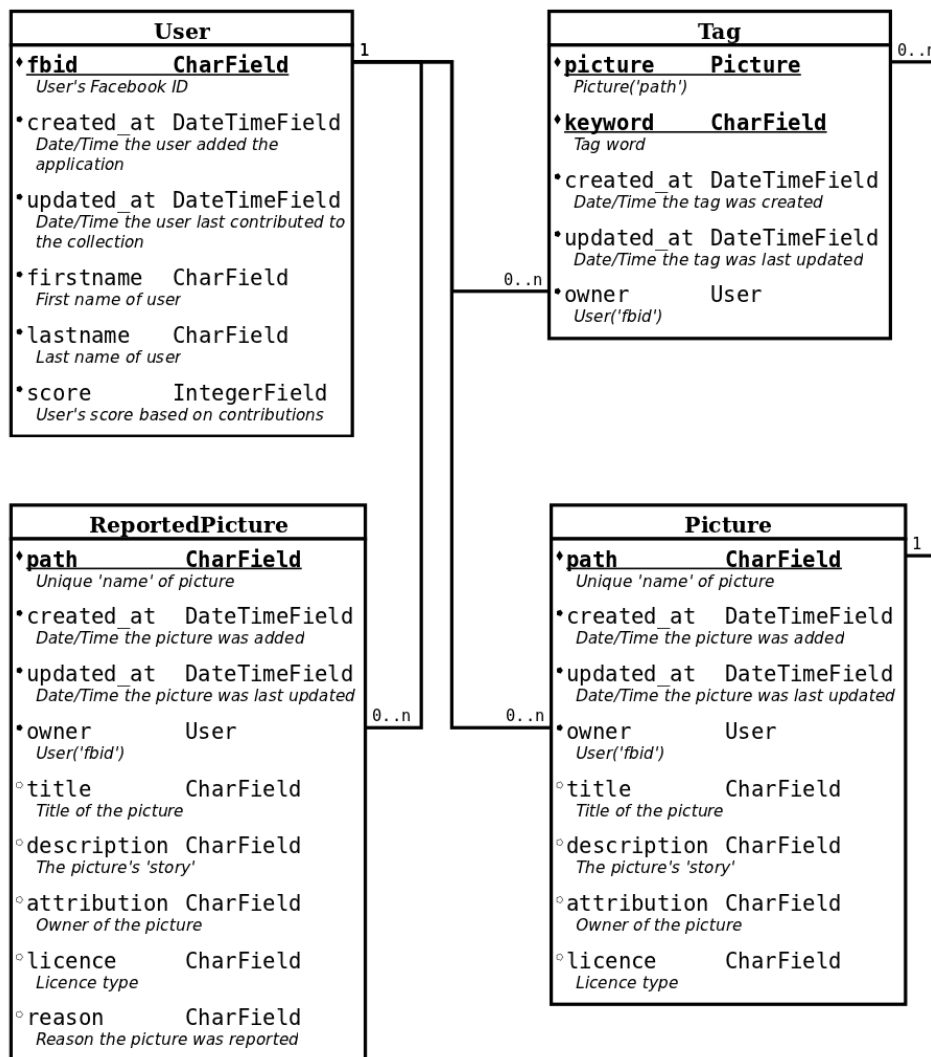


FIGURE 4.7: THE DATABASE SCHEMA

The User table has a primary key “fbid” that is the user’s Facebook ID. The other User fields are “created_at”, “updated_at”, “firstname”, “lastname” and “score”. The score is calculated based on how many pictures, tags and metadata fields the user has shared. The reason the score is stored in the database is to save time by the application when displaying leaderboard results. Saving the users’ scores makes them easily available without multiple calls to the database that are required for calculation. Each time the user adds a picture, tag or picture information, the score is recalculated. The user’s first name and last name are accessed using the Graph API. The “updated_at” field is used in the leaderboard in situations where more than one user has the same score. As this field changes each time the score changes, which likewise changes each time a user adds pictures, tags and metadata, the field is an indication of how recently the user actually provided data. In such a situation, the more recently updated user gets a higher position on the leaderboard in order to motivate users to provide data.

The Picture table has a primary key “path”. The “path” is the unique picture ID described above. The Picture table also has the fields “created_at”, “updated_at”, “owner”, “title”, “description”, “attribution” and “licence”. The “owner” is the User who added the picture, identified by “fbid” from the User table. The “title” field allows the user to give the picture a title or name. The “description” field has a higher maximum character allowance, which is used to describe the picture with a story. In the case where the user does not own the picture, the user can give attribution to the actual owner using the “attribution” field. As the actual owner might not have been a user of the application, this field was not a User, but rather a CharField. The “licence” field is used to identify which licence the user is sharing the picture under. The user is given the option of two Creative Commons licences: Commercial-Use-Allowed and Non-Commercial-Use-Allowed, as discussed in Section 4.2.5. The “licence” field holds only a single character associated with the licence. The ReportedPicture table, is much the same as the Picture table, however the extra field “reason” is included. The ReportedPicture table is used to store pictures and metadata when a picture is reported, for example if a user believes the picture to be inappropriate or an infringement of copyright. This is for the purpose of retrieving the picture at a later stage if the picture is not reported for valid reasons. The “reason” field contains the explanation given by the user who reported the picture. Section 4.2.5 gives examples of valid reasons for reporting a picture.

As well as “created_at” and “updated_at”, the Tag table has the fields “keyword”, “owner” and “picture”. The “keyword” is the actual tag word which would appear in the tag cloud or with the picture. The “owner” is the User who

created the tag, identified by “fbid” from the User table. The “picture” is a Picture identified by “path” from the Picture table. Tags are not necessarily unique, as the same keyword can be associated with a number of different pictures. However, once a keyword is associated with a particular picture, a new tag will not be created to represent the same association.

4.2.4 The User Interface

4.2.4.1 Viewing Pictures

The gallery (Figure 4.8, Figure 4.9, Figure 4.10 and Figure 4.11) consists of one larger picture with eight smaller pictures underneath. A user can browse through the smaller pictures by clicking the arrows on the left or right. AJAX was used so that only the thumbnails are refreshed and not the entire application. A page number gives the user an idea of where the user is looking in the collection. The smaller pictures are ordered, with the most recently added pictures appearing first. This creates interest for users who open the application as new pictures will be available for browsing. Displaying a user’s newly added picture first, may also be gratifying to the user as their contribution will be seen first by other users. Clicking the smaller pictures opens the larger version. In the case of Figure 4.8, the picture on the top far right corner was selected. The small pictures are loaded from the “thumbnail” S3 bucket. The larger picture is loaded from the “dissemination” S3 bucket. This ensures that the pictures are loaded quickly. The picture in the “archival” S3 bucket is not used in the gallery but is kept only for archival purposes. A list of tags associated with the larger image is displayed under the large image. In the example in Figure 4.8 the tags are “Houston”, “Texas” and “Harbour”. Clicking these tags or clicking tags in the tag cloud or searching with the search box results in all pictures associated with the tag being displayed in the gallery. This can be seen in the example in Figure 4.10, where “Cape Town” is the selected tag. The gallery can also be used to view the user’s own collection. The user navigates to their collection by clicking “My Collection”. This displays only the pictures the user has uploaded in the gallery, as seen in Figure 4.11.

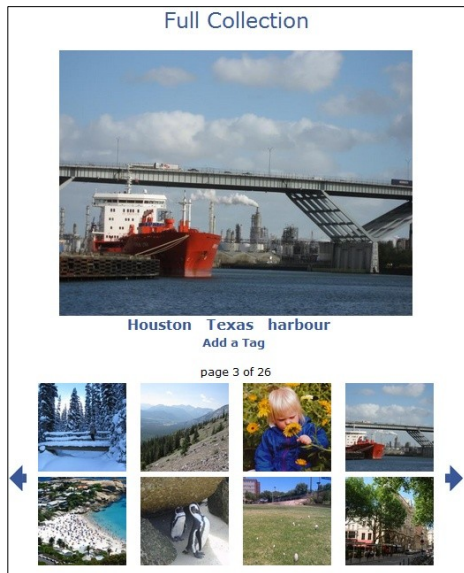


FIGURE 4.8: GALLERY

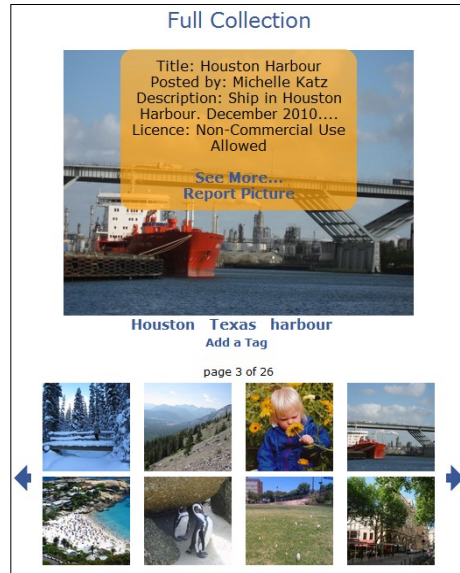


FIGURE 4.9: GALLERY SHOWING METADATA

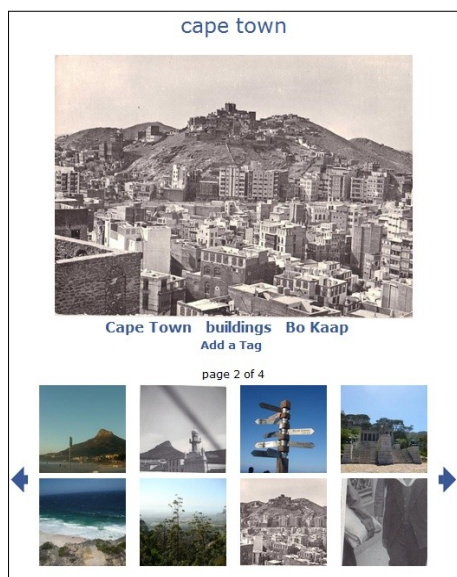


FIGURE 4.10: TAG GALLERY: CAPE TOWN

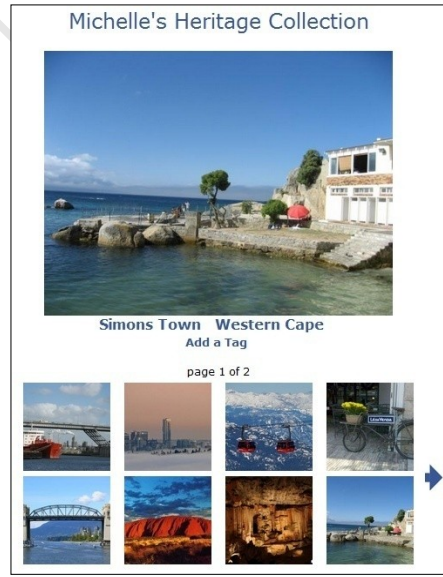


FIGURE 4.11: USER'S COLLECTION

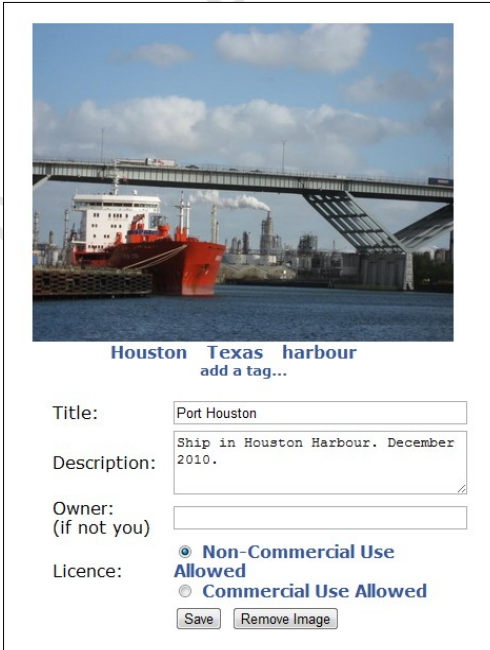
4.2.4.2 Viewing and Editing Metadata

A mouse-over on the enlarged image allows the user to see the image metadata. Figure 4.9 shows the same image as in Figure 4.8, however with a mouse-over on the image. In this example the metadata reads:

Title: Houston Harbour
Posted by: Michelle Katz
Description: Ship in Houston Harbour. December 2010...
License: Non-Commercial Use Allowed

The description displayed is limited to 40 characters. Therefore, to see the rest of the description the user must click the “See More...” link. In the case where the user had posted the picture, the user is also able to edit the metadata, as can be seen in Figure 4.12. In Figure 4.12 the user edited the title of the image displayed in Figure 4.8 and Figure 4.9 to “Port Houston”. The user also has the option of removing the picture from the collection, which would delete the picture from the database.

A mouse-over on the picture (See Figure 4.9) also gives an option to “Report Picture”. This link takes the user to a page where the user is asked to confirm reporting the picture as well as to provide reasons for reporting it.



Houston Texas harbour
add a tag...

Title:

Description:

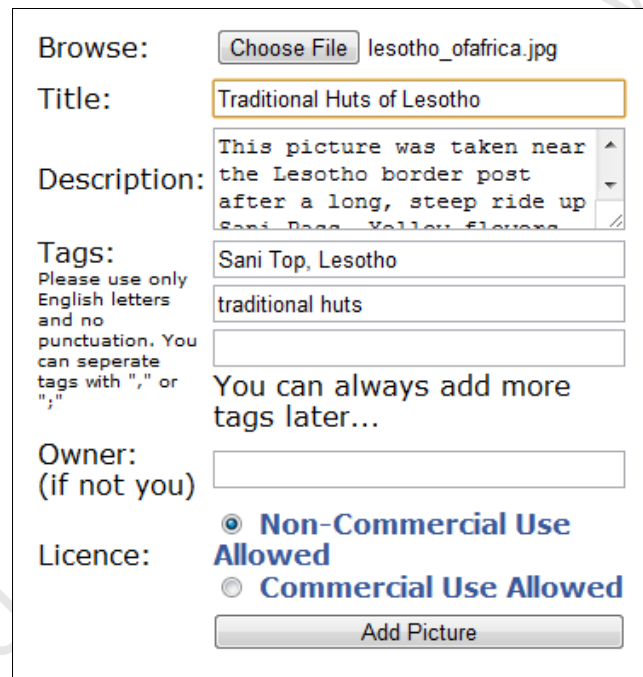
Owner: (if not you)

Licence: Non-Commercial Use Allowed
 Commercial Use Allowed

FIGURE 4.12: VIEWING AND EDITING METADATA

4.2.4.3 Adding a Picture and Metadata

A user can add pictures by clicking on “Add a Picture”. The application then displays a form as shown in Figure 4.13. Here the user can browse the file system for a picture to upload and can fill in the metadata fields. All fields are optional. However filling in metadata fields will increase the user’s score. The metadata fields available are title, description, owner and licence. The owner field allows the user to give attribution to the owner of the picture in the situation where the user is not the owner. If the user does not have permission to share the picture, infringement of intellectual property can be reported (see Section 4.2.5). The user can also add tags. See Section 4.2.3 for more information on the metadata fields.



The form contains the following elements:

- Browse:** A "Choose File" button next to the filename "lesotho_ofafrika.jpg".
- Title:** A text input field containing "Traditional Huts of Lesotho".
- Description:** A text area containing "This picture was taken near the Lesotho border post after a long, steep ride up Sani Top, Yellow flowers".
- Tags:** A section with instructions: "Please use only English letters and no punctuation. You can separate tags with ',' or ';'". It includes two text input fields containing "Sani Top, Lesotho" and "traditional huts". Below the fields is the text "You can always add more tags later...".
- Owner: (if not you):** An empty text input field.
- Licence:** Two radio button options: "Non-Commercial Use Allowed" (selected) and "Commercial Use Allowed".
- Submit:** An "Add Picture" button.

FIGURE 4.13: ADDING A PICTURE AND METADATA

4.2.4.4 Browsing Tags

Tags are displayed in a tag cloud in alphabetical order as seen in Figure 4.14. The size of the font corresponds to the frequency of use of the tag. To prevent the tag cloud from expanding indefinitely, the cloud is limited to 50 tags. Only the most frequently used tags appear in the tag cloud. However, the user still has access to tags that are not in the tag cloud, either by finding them when browsing the gallery or by using the search box. Clicking a tag or using the search box results in the gallery displaying all images associated with the tag as in Figure 4.10.



FIGURE 4.14: THE TAG CLOUD

4.2.4.5 Competing with Others

When the user adds pictures, tags or metadata, his/her score would improve as well as his/her position on the leaderboard. A mini-leaderboard on the side of the gallery shows the user his/her position on the leaderboard in comparison to his/her nearest competitors. The top three users are always shown as well as two users above and two below the current user. Figure 4.15 shows two examples of the mini-leaderboard where the current user is shown in bold. The users' names have been blurred for anonymity. In the mini-leaderboard on the left, the current user is rated #5 and in the mini-leaderboard on the right the current user is rated #15. This system lets the current user compete with other users nearest to him/her in rank while still giving the top players credit.

#1	J...e
#2	M...a
#3	E...a
#4	M...or
#5	M...tz
#6	J...o
#7	J...a
	...

#1	J...e
#2	M...a
#3	E...a
	...
#13	M...a
#14	N...i
#15	D...s
#16	J...z
#17	A...i
	...

FIGURE 4.15: THE MINI-LEADERBOARD

Above the mini-leaderboard is a link called "leaderboard". This takes the user to a more detailed leaderboard that shows not only rank but score and profile picture as well. As can be seen in Figure 4.16, there are three leaderboards available to the user. First is the main leaderboard which displays all users in order of rank. There is also a "Top 10" leaderboard that only displays the top ten players. Next, there is a "Friend Leaderboard". This leaderboard ranks the user only against his/her Facebook friends. This leaderboard accesses the user's friend list using the Facebook Graph API (as described in Section 4.2.2) and compares it to the user list in the application database.

Leaderboard

Friends | Top 10 | Leaderboard

Rank	Score	Picture	Name
#1	193		[Redacted Name]
#2	135		[Redacted Name]
#3	124		[Redacted Name]
#4	99		[Redacted Name]
#5	86		[Redacted Name]
#6	57		[Redacted Name]
#7	54		[Redacted Name]
#8	40		[Redacted Name]
#9	38		[Redacted Name]
#10	35		[Redacted Name]

1 2 3 4 5 6 7 8

FIGURE 4.16: THE LEADERBOARD



FIGURE 4.17: A POST TO THE USER'S WALL

4.2.4.6 Publishing to the User's Wall

When a user adds a picture to the collection, he/she is given the option of allowing the application to share the contribution in a wall post. Posting to the user's wall is a useful way for Facebook applications to advertise. However, many users dislike having applications post to their wall. It was for this reason that users are asked for permission to post to their walls. Like other Facebook wall posts, Facebook users can "like" or "comment" on the post, as seen in Figure 4.17.

4.2.5 Ethical Issues

When adding a photograph to the collection, the user can specify who owns the photograph (if it is not owned by the user) as well as what license agreement the photograph is available under. For the purpose of this research, the user could choose between two Creative Commons Licenses, namely: Attribution-NoDerivs 3.0 Unported²³ and Attribution-NonCommercial-ShareAlike 3.0 Unported²⁴. A photograph with an Attribution-NoDerivs 3.0 Unported license may be copied, distributed and transmitted for commercial use under the conditions that the work is attributed to the owner and may not be altered, transformed or built upon. A photograph with an Attribution-NonCommercial-ShareAlike 3.0 Unported license may be copied, distributed, transmitted and adapted under the conditions that commercial use is not allowed, attribution must be made to the owner and if the work is altered, transformed, or built upon, the resulting work may be distributed but only under the same or similar license.

The user who does not want to use one of these Creative Commons licenses has the option of not specifying a license, not sharing the photograph or removing the photograph from the collection.

If a picture that is added to the collection violates copyright or infringes on intellectual property or if it is spam or scam, if it contains nudity, pornography, graphic violence, hate speech or symbols or illegal drug use or if the content is generally inappropriate, the picture can be reported. When a picture is reported it is removed from the gallery. However, it is kept both in the collection of images stored in the S3 buckets as well as in the database. The picture is moved from the usual "Picture" table in the database to a "Reported Picture" table. From there it could be reviewed to ensure that the picture was reported for valid reasons.

²³ <http://creativecommons.org/licenses/by-nd/3.0/>

²⁴ <http://creativecommons.org/licenses/by-nc-sa/3.0/>

4.3 SUMMARY

The application was developed using an iterative approach of design, implementation and evaluation. The application allows users to view pictures added by others, view their personal collection, browse the pictures by tags, add and tag their own pictures and add metadata for their pictures. Users earn points for participation and a leaderboard displays the users' ranks. The pictures are stored in Amazon S3 buckets whereas user details, tags and picture metadata are stored in a MySQL database. Accessing user details and posting to the user's wall is achieved through Facebook's Graph API.

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Evaluation

This project investigates the ability of a Facebook application to create heritage collections by motivating users to contribute heritage pictures and metadata. This chapter discusses how the application was evaluated. The results are grouped by:

1. **User Experience:** The user experience of the application gives an indication as to whether the application can bring in new users and retain existing users. For example, if the users have a positive experience of the application, they are more likely to continue to use the application and to recommend the application to their friends.
2. **Motivation:** Two forms of motivation were compared within this research, namely: competitive (motivated by position on a leaderboard) and non-competitive (motivated by badges).
3. **Competition:** The specific method of motivation chosen to encourage users to contribute data was to create competition among users. Users were awarded points for each contribution of pictures, tags and metadata. Therefore, the more competitive users feel, the more likely they are to contribute to the collection.
4. **Usage:** The usage of the application refers to the actual number of users, pictures, metadata and tags that the application accumulated, as well as the way in which the application was used.

The evaluation of the application was carried out for the purpose of answering the research questions discussed in Section 5.1. The methodology of the evaluation is explained in Section 5.2 and the results are presented and discussed in Section 5.3.

5.1 AIM

The aim of the evaluation process was to answer the following research questions in relation to the final system described in Section 4.2:

- 1) How effective is the application on a social network at building heritage collections?**
- 2) How effective is the application on a social network at labelling, heritage collections with metadata and tags?**
- 3) How can users be motivated to contribute to the collection?**

In order to answer questions 1 and 2, the final system must be evaluated in terms of whether it brings in users and motivates them to contribute (pictures for question 1 and metadata and tags for question 2). The two motivation approaches, competitive and non-competitive, must be compared in order to answer question 3. As the motivation approach chosen for the final system was to encourage competition between users, the application must also be evaluated in terms of whether it motivates users to compete. The users should be encouraged to continue to use the application and to recommend the application to friends, thereby bringing in new users. For this reason, users must have a positive user experience.

5.2 METHODOLOGY

A survey was conducted using LimeSurvey in order to evaluate the system. The survey was adapted from work by Lund (2001) as well as AttrakDiff²⁵ which offers a basic, free of charge evaluation service. There were thirty participants in the survey. Participants were paid R40 to participate. However, some volunteered, refusing remuneration. Almost all the participants were between the ages of 20 and 29. There were 14 female and 16 male participants. Most participants had received bachelor's or honour's degrees in varying fields. Ethical clearance and permission to access students was granted by the University of Cape Town for this research. Informed consent

²⁵ <http://www.attrakdiff.de/en/>

was agreed on by the participants, who were informed that as the application was based in Facebook, a social networking site, the use of the application would be public.

The participants were asked to follow the instructions of a task list, contribute heritage related images and then answer the survey questions. Through the task list the participants were introduced to the application functions. The task list completed by the participants was as follows:

Task 1: Log in to your Facebook account (if possible, using Google Chrome or Mozilla Firefox). Open the Facebook application found here: <https://apps.facebook.com/heritagered/>. If you have not already done so, add the application.

Task 2: Browse through pictures in the gallery. You can use the arrows to see more pictures. Clicking on a picture will enlarge it. Hover over the enlarged pictures to see information on the picture.

Task 3: Look at the tag cloud on the left of the gallery. Use the tag cloud to browse through topics of interest. You may also try the search box.

Task 4: Find a picture that interests you. Click "Add a Tag" and choose a useful tag to describe the picture.

Task 5: Navigate to the Leaderboard by clicking the link above the mini-leaderboard. Check your ranking against your friends and on the main leaderboard.

Task 6: Click "Add a Picture" in the menu. Upload a picture and include some information.

Task 7: Have a look at your leaderboard position and see if it has changed.

Task 8: You can view your collection by clicking on "My Collection". Roll your mouse over your picture and click "See More". If you would like, here is where you can edit the information on your picture. Add a story or explanation of your picture in the "Description" box.

Task 9 (Optional): Continue to add more pictures and compete with your friends and other users.

For the full survey questions please refer to the Appendix.

5.3 RESULTS AND DISCUSSION

The results discussed in this section refer specifically to the final design except for section 5.3.1, which refers to comparison made between System 2, the competitive system, and System 3, the non-competitive system.

5.3.1 Badge versus Score

The results of this section refer to Evaluation 2 introduced in Section 4.1.3. These results influenced the features chosen for the final system.

The main purpose of the second evaluation was to compare motivation approaches and see how effective the social features were at promoting participation by users. This evaluation was conducted in order to answer research question 3. The three systems were compared. System 1, which was slightly improved on from the previous evaluation, had no social features and no direct motivation to contribute. Systems 2 and 3 were both social with direct motivation to contribute – however System 2 was competitive whereas System 3 was not. These three systems were identical in every other way. Participants were asked to use the applications and complete a survey. No detailed instructions were given. The survey was created using Lime Survey²⁶. In order to ensure that the questions made sense and were not ambiguous, a pilot survey was conducted. Two people participated in the pilot survey. The survey questions were adjusted slightly, based on the responses of these participants. Twenty five people participated in the survey. Figure 5.1 shows the percentage of participants who answered “yes”, “no” and “uncertain” to questions:

Have you added pictures / tags / information²⁷ in order to improve your badge / score?

In all cases, the percentage of participants who answered “yes” was higher for score than for badge. For the case of tags and information, the responses were almost equally weighted between “yes” and “no” for both badge and score. However, the “yes” responses for pictures were clearly higher than “no” responses for both badge and score.

Therefore, participants are more motivated to contribute to improve their score than to improve their badge. The difference in responses to adding pictures versus adding tags or information suggests that many participants

²⁶ <http://www.limesurvey.org/>

²⁷For better understanding by participants, “metadata” was referred to as “information”.

were possibly unaware that adding tags or information would improve their badge or score.

Comparison of Badge and Score as Motivating Factors in Contributing Pictures, Tags or Information

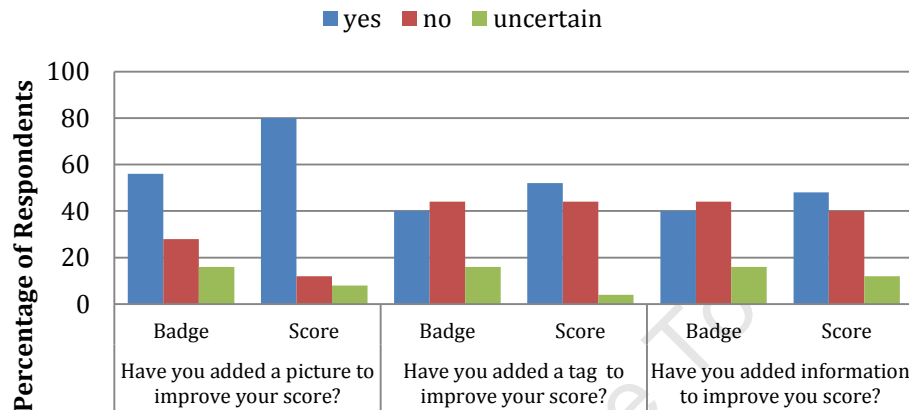


FIGURE 5.1: GRAPH COMPARING BADGE AND SCORE AS MOTIVATING FACTORS

5.3.2 User Experience of the Application

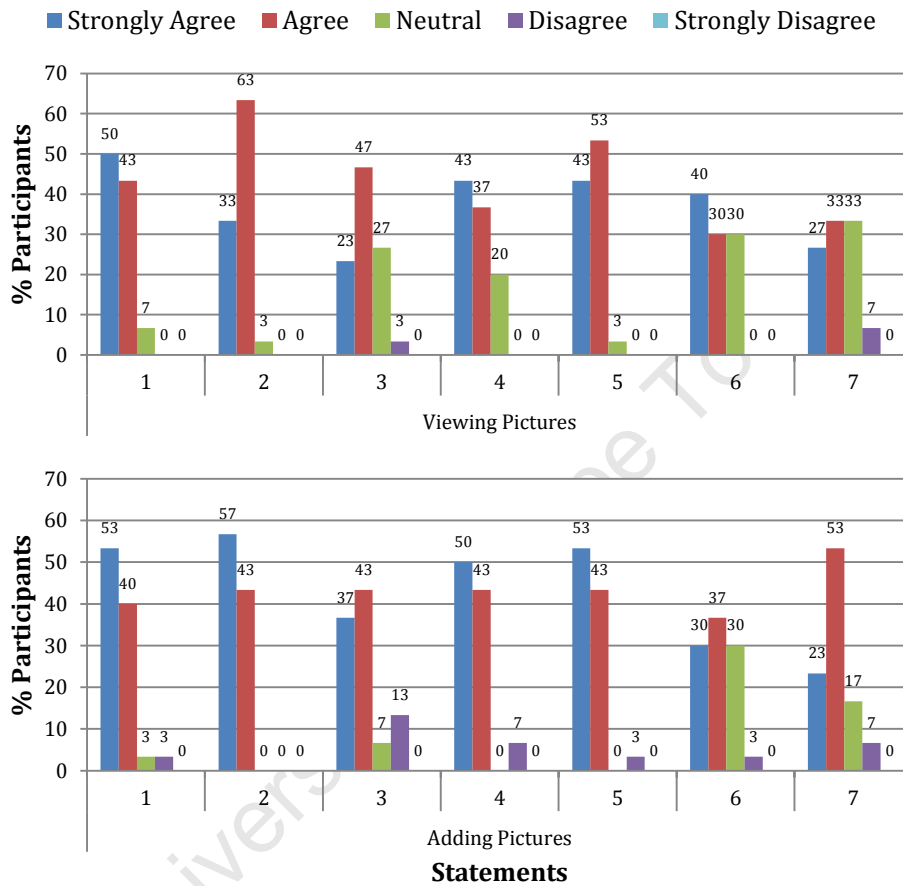
The user experience of the application gives an indication of whether the users are likely to spend time on the application contributing data, whether they are likely to continue using the application and whether they will recommend the application to friends. These factors influence the application's abilities to collect heritage pictures as well as metadata and tagging. It is therefore necessary to evaluate the user experience as it will help to answer the first two research questions.

5.3.2.1 Function Ratings

Participants were asked to choose "Strongly Agree", "Agree", "Neutral", "Disagree" or "Strongly Disagree" for each of the following statements: "I found this function easily", "It could be useful", "It does everything I would expect it to do", "It is easy to use", "I can use it successfully every time", "It is fun to use" and "It works the way I want it to work". These survey questions were adapted from work by Lund (2001) on user experience questionnaires. The results, shown in Figure 5.2, Figure 5.3 and Figure 5.4 are discussed below. Each graph is associated with a function. The percentage of participants is shown on the y-axis. For each statement, bars associated with

Strongly Agree”, “Agree”, “Neutral”, “Disagree” and “Strongly Disagree” are shown on the x-axis.

Participant Rating of Picture Functions



1. I found this function easily
2. It could be useful
3. It does everything I would expect it to do
4. It is easy to use
5. I can use it successfully every time
6. It is fun to use
7. It works the way I want it to work

FIGURE 5.2: RATING OF PICTURE FUNCTIONS

Picture Functions:

The results for the picture functions can be seen in Figure 5.2. Most participants agreed that they found the gallery (viewing pictures function) easily, that it could be useful and that they could use it successfully every time. The majority of participants also agreed that the gallery did everything expected, was easy and fun to use and worked the way they wanted it to work. Some participants, however, were neutral. Very few of the participants disagreed that the gallery did everything expected or that it worked as the participants wanted it to. No participants strongly disagreed with any of the qualities.

For most qualities of the function to add pictures, the participants reacted positively. Over 90% of participants agreed (over 50% of participants strongly agreed) that they found the function easily, it was easy to use and they could successfully use it every time. All participants agreed that it could be useful. Most users also agreed that the function to add pictures did everything expected, it was fun to use and did everything the participant wanted. Some participants were neutral toward the function being fun and doing all that they wanted. A few participants disagreed with these qualities. No participants strongly disagreed with any of the qualities.

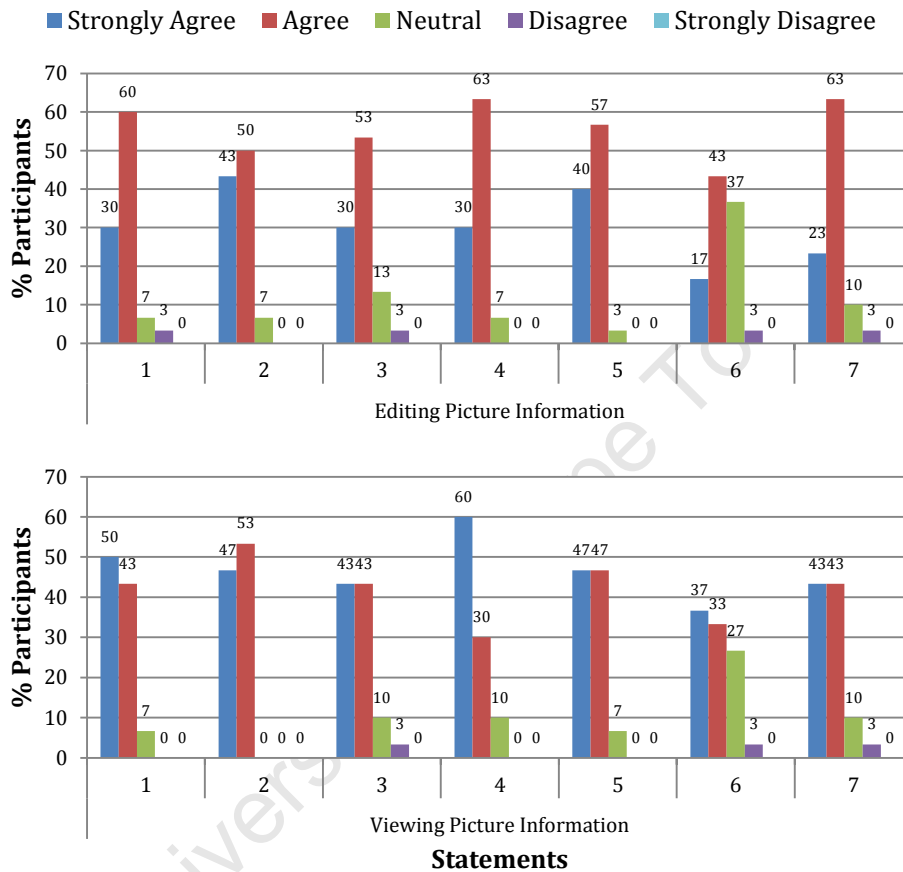
Picture Information Functions:

Refer to Figure 5.3 for the results of the picture information functions. Once again, most participants agreed with all the qualities for the function to edit picture information. However the number of participants who strongly agreed is lower than for the other features. There were a number of participants who were neutral as to the feature being fun to use. Very few participants disagreed with any of the qualities although no participants strongly disagreed.

The participants reacted positively to viewing picture information. All participants agree that it could be useful. Most participants agreed or strongly agreed that they could find the feature easily, it did everything expected, it was easy to use, they could use it successfully every time and it worked as they wanted it to. There were also a few users who were neutral. Although the majority of participants agreed or strongly agreed that the feature was fun to use, a number of them were neutral. There were a few "disagree" responses that the feature did what was expected, was fun to use and did all that the participant wanted it to do. However, these were not from the same participant. One of the participants explained that the reason for disagreeing was because he/she expected to be able to perform image processing

(rotating or blurring for example) on the pictures. This however is outside the scope of this research. No participants strongly disagreed.

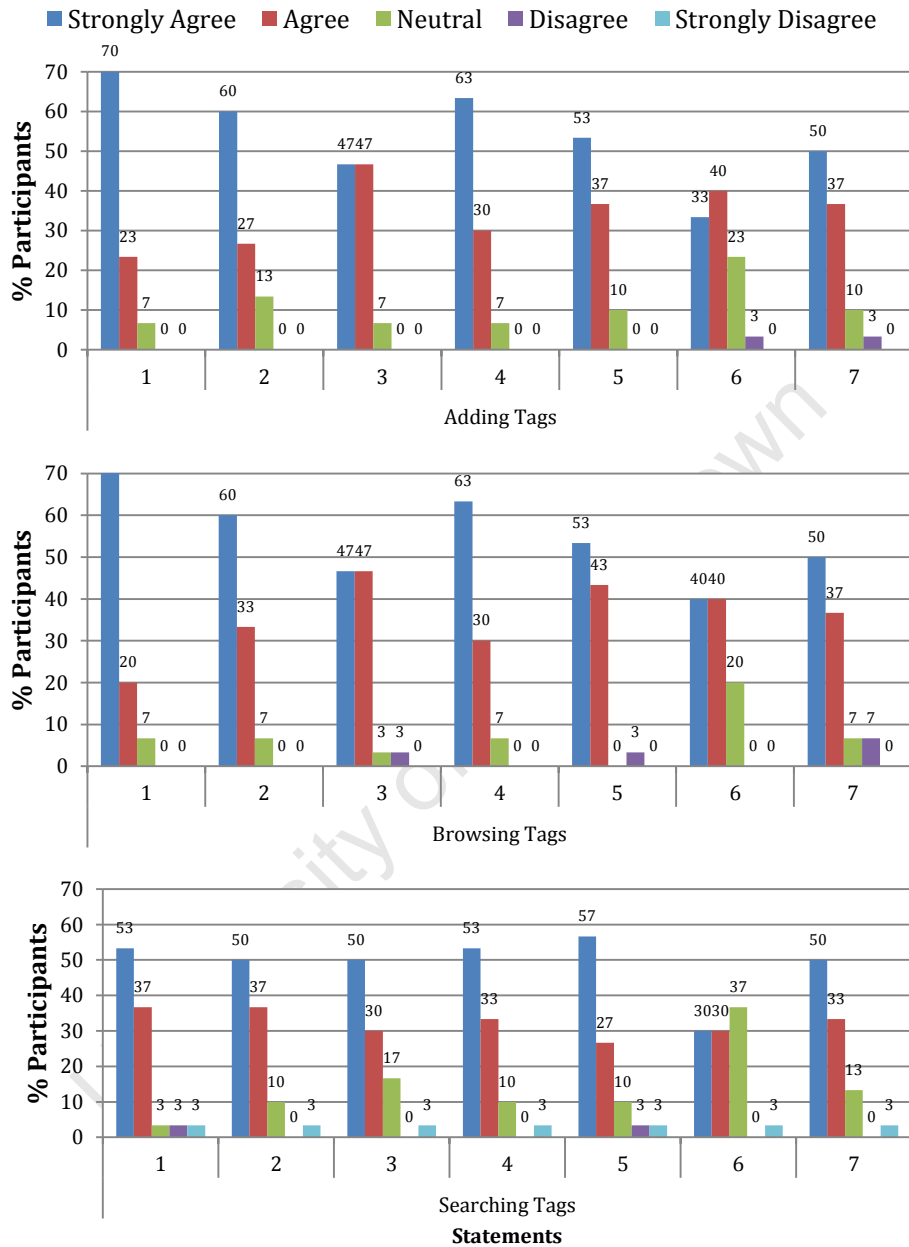
Participant Rating of Picture Information Functions



1. I found this function easily
2. It could be useful
3. It does everything I would expect it to do
4. It is easy to use
5. I can use it successfully every time
6. It is fun to use
7. It works the way I want it to work

FIGURE 5.3: RATING OF PICTURE INFORMATION FUNCTIONS

Participant Rating of Tag Functions



1. I found this function easily
2. It could be useful
3. It does everything I would expect it to do
4. It is easy to use
5. I can use it successfully every time
6. It is fun to use
7. It works the way I want it to work

FIGURE 5.4: RATING OF TAG FUNCTIONS

Tag Functions:

As seen in Figure 5.4, the tag functions generally received the most positive feedback from users, with large portions of the participants strongly agreeing with the statements.

Most users strongly agreed that they found the feature to add tags easily, it could be useful, it was easy to use and the participants could use it successfully every time. No participants disagreed with those statements, however few were neutral. Most users also strongly agreed or agreed that adding tags did everything expected, was fun to use and worked the way the participant wanted it to work. Some participants were neutral to these statements. Very few participants disagreed that the feature was fun to use and worked the way participant wanted it to. A participant explained “Only found not adding a tag fun because I could not find many pictures that appealed to my ideas of my heritage”. However no participants strongly disagreed with any of the statements.

The browsing tags feature received the most strongly agree responses than any other feature. 40% of participants strongly agreed that the feature was fun to use and up to 73% strongly agreed that the feature was easy to find. At least 80% of participants strongly agreed or agreed with all the statements. All except one participant strongly agreed or agreed that that they could use the function successfully every time. Almost all participants agreed or strongly agreed that the feature was easy to find, could be useful, did everything expected and was easy to use. Although most participants agreed or strongly agreed that the feature worked the way they wanted it to work, a few participants were neutral or disagreed. No participants strongly disagreed with any of the statements.

At least half the participants strongly agreed that the search feature was easy to find, it could be useful, it did everything expected, it was easy to use, the participant could use it successfully every time and it worked as the participants wanted it to work. Some participants gave a “neutral” response to the statements. The number of “neutral” responses for the feature being fun was higher than the strongly agree or agree responses. Although most participants either strongly agreed or agreed that the function was fun to use, this is the only statement across all functions²⁸ that did not receive either a “strongly agree” or “agree” as its highest response. One participant strongly disagreed with all the statements, although this participant did not provide a

²⁸ The viewing picture function received the same number of “agree” responses as “neutral” responses for the statement number 7, “it worked the way I wanted it to work” (see Figure 5.2).

reason in the comment box provided. A few participants mentioned that it was not yet necessary for them to use the search box.

The results of the user experience of the functions shows that for all functions participants had a positive user experience. In general participants preferred adding pictures to viewing pictures which is ideal for a collection grown by user contributions. However, participants preferred viewing picture information over editing picture information. Adding and browsing tags were the most popular features. These results show that users positively experience adding pictures as well as providing tags and metadata.

5.3.2.2 General Ratings

Participants were asked to rate the application on ten five-point scales, adapted from those used by AttrakDiff. The scales are shown in question G3 of the Appendix. For each scale, the participant rates the application between two attributes, for example between “Clear” and “Confusing”. For the purpose of analysing the results of this data, the two points on the far left refer to the attributes on the left, two points on the far right refer to the attributes on the right and the middle point is “neutral”. An example is shown in Figure 5.5 where the scale is between “Clear” and “Confusing”. The results can be seen in Figure 5.6 and Figure 5.7. Each section or rating scale is shown on the y-axis. For each section, the top two bars refer to the attributes on the top. The bottom two bars refer to the attributes at the bottom and the middle bar is “Neutral”. This is indicated in Figure 5.5 where the attributes are “Clear” and “Confusing”. The x-axis is the percentage of participants.

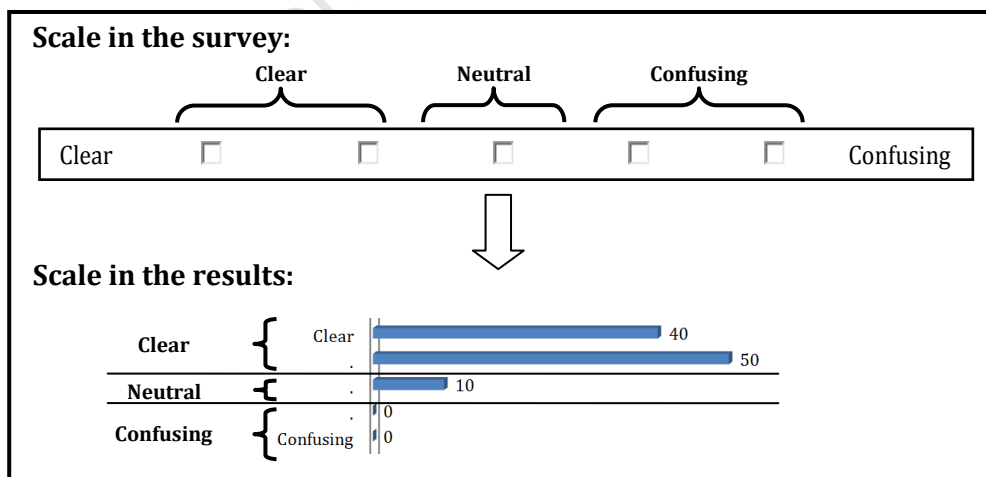


FIGURE 5.5: RATING SCALES – FROM SURVEY TO RESULTS

In general, the responses of the participants were positive. The majority (63%) of participants rated the application as “Fun”, however 33% of

participants were “Neutral” and 3% rated the application “Boring”. These results are consistent with the per feature ratings shown in Figure 5.2, Figure 5.3 and Figure 5.4 for the statement “It is fun to use”. However, 77% of participants rated the application as “Enjoyable”, with only 23% “Neutral” responses and no “Frustrating” responses. Almost all participants agreed that the application was “Interesting”, with one “Neutral” response and one “Disengaging” response. Although 57% of participants rated the application as “Inviting”, there were many “Neutral” responses and one “Repelling” response. Most participants rated the application “Practical”, with only a few “Neutral” responses and one “Impractical” response. Apart from a few “Neutral” responses, the application was generally rated as “Effective”. No participants rated the application as “Ineffective”. All the participants agreed that the application was “Simple”. Almost all participants rated the application as “Clear”, though there were a few “Neutral” responses. No participants rated the application as “Complicated” or “Confusing”. Although there was one “Neutral” response, all other participants agreed that the application was “Easy”. The application was mostly rated “Social” by participants, however there were some “Neutral” and “Non-Social” responses.

Therefore, the majority of participants rated the application as “Fun”, “Enjoyable”, “Interesting”, “Inviting”, “Practical”, “Effective”, “Simple”, “Clear”, “Easy” and “Social”. Once again, this shows that the users had a positive experience of the application.

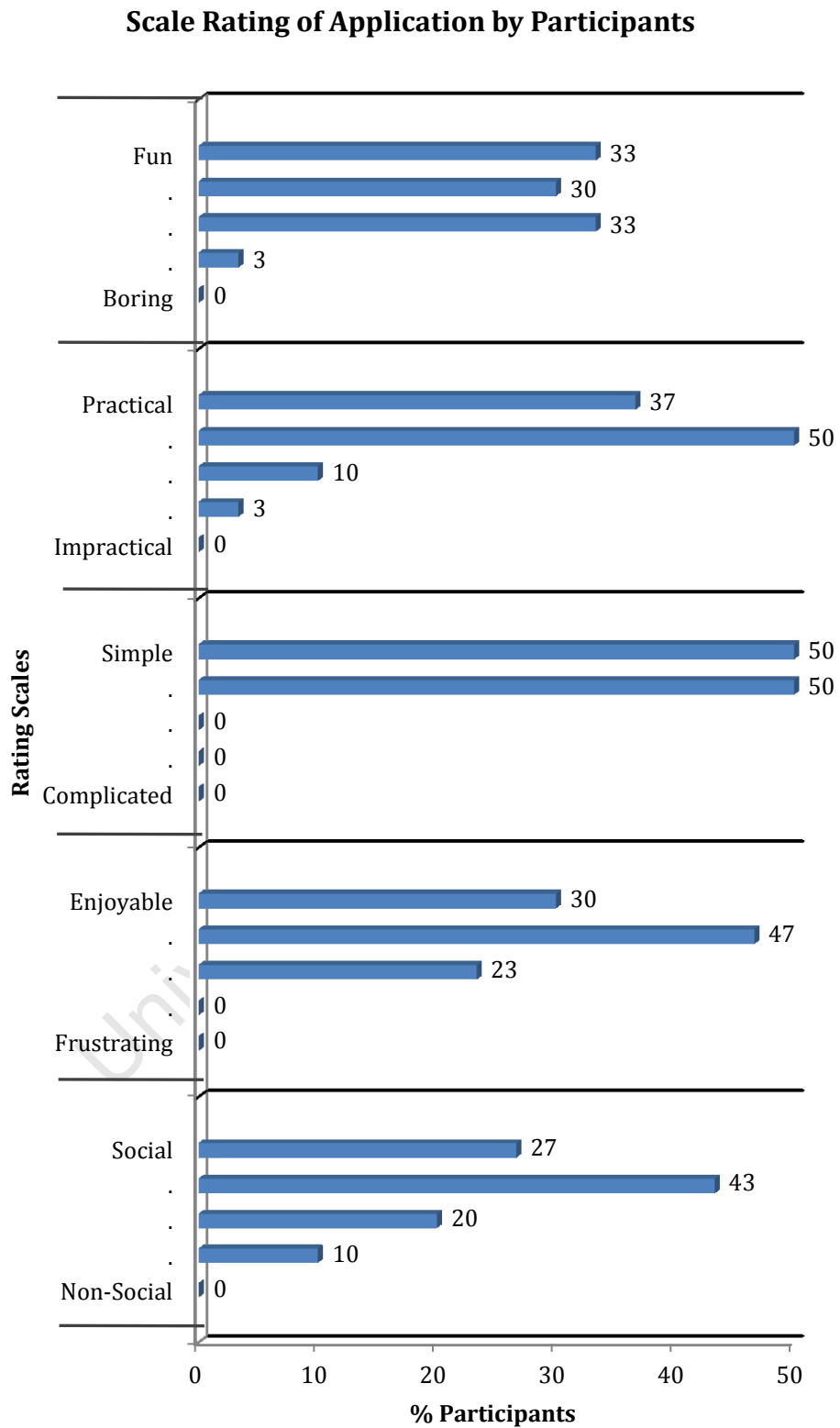


FIGURE 5.6: SCALE RATING OF APPLICATION BY PARTICIPANTS (A)

Scale Rating of Application by Participants

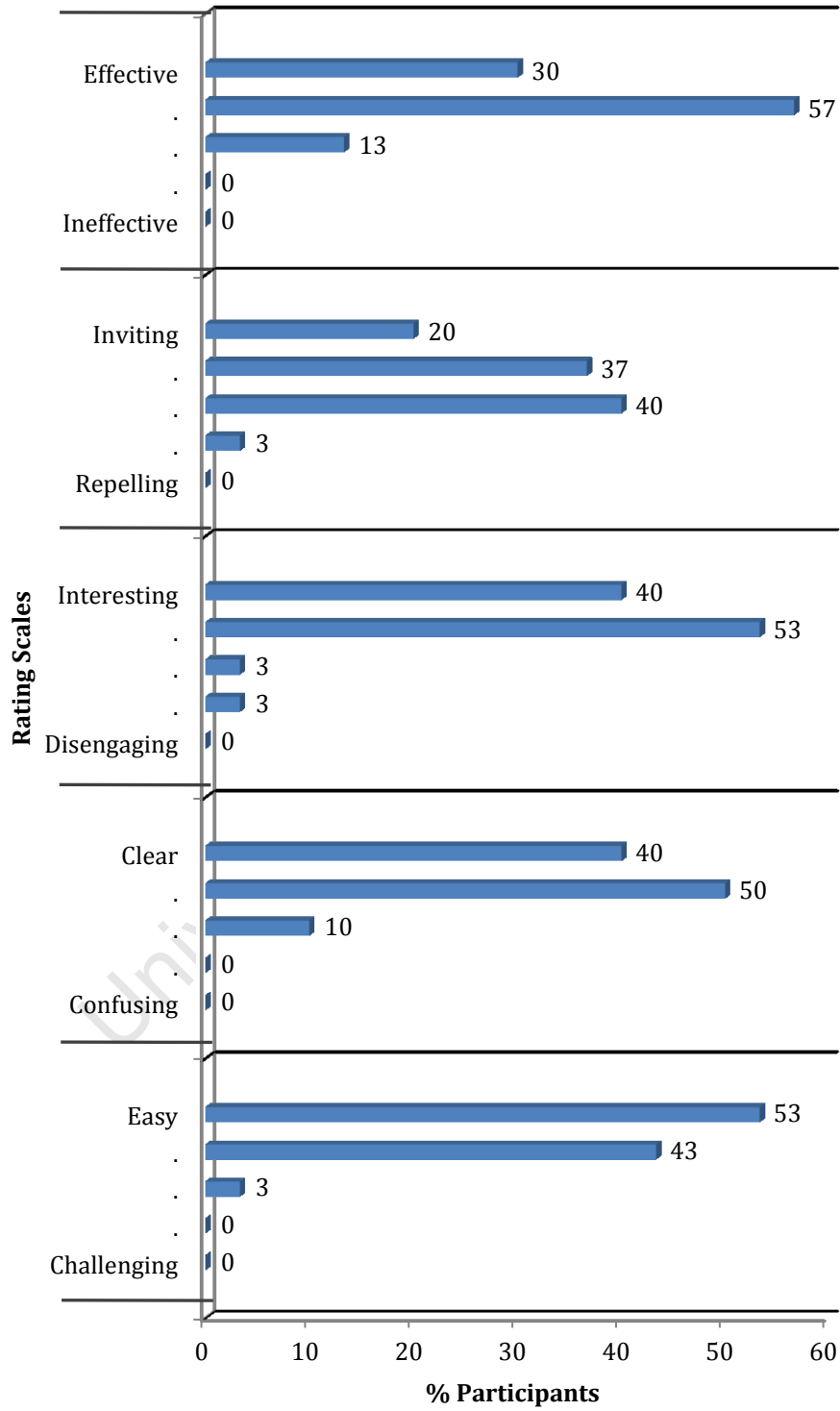


FIGURE 5.7: SCALE RATING OF APPLICATION BY PARTICIPANTS (B)

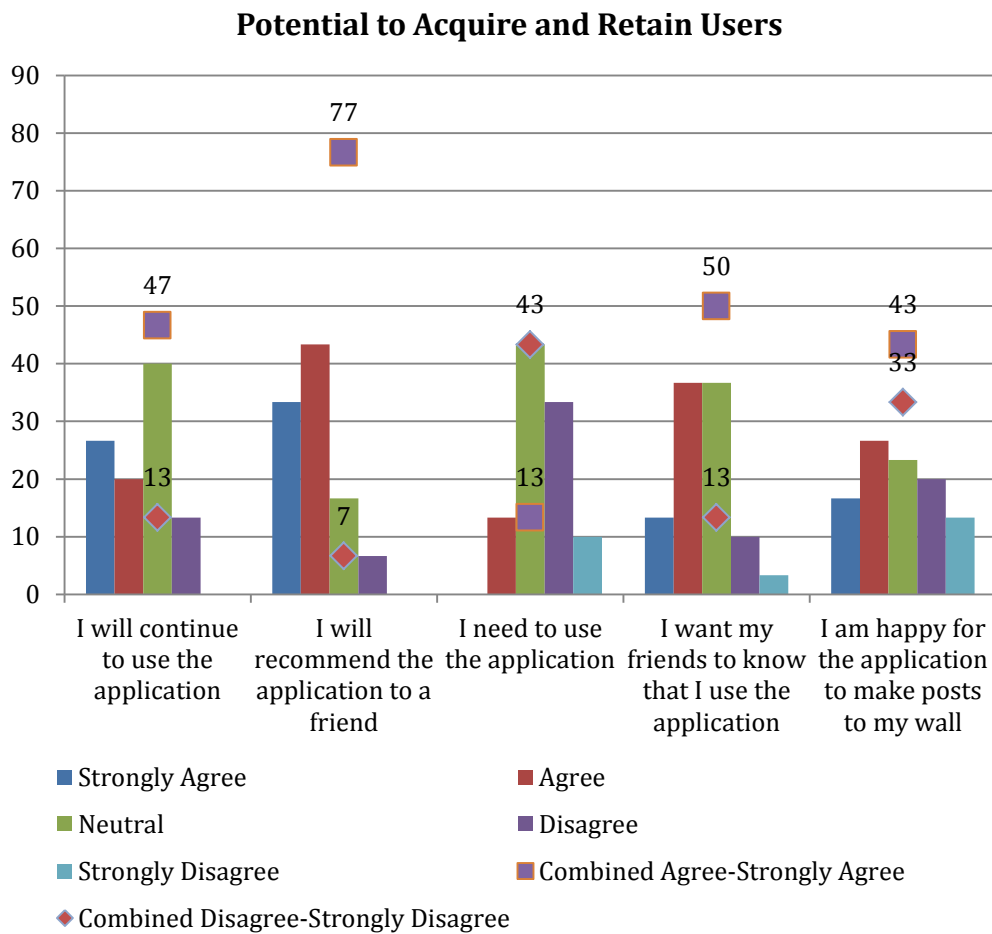


FIGURE 5.8: POTENTIAL TO ACQUIRE AND RETAIN USERS

Figure 5.8 shows the participants' responses to the statements: "I will continue to use the application", "I will recommend the application to a friend", "I need to use the application", "I want my friends to know I use the application", "I am happy for the application to make posts to my wall". In order to see more clearly the percentage of users who agreed and disagreed with these statements, scattered points were added to the chart. The combined results for "Strongly Agree" and "Agree" are shown by a square marker. The combined results for "Strongly Disagree" and "Disagree" are shown by a diamond marker.

The largest group of participants agreed or strongly agreed that they would continue to use the application. However, many of participants were "Neutral". A few participants disagreed that they would continue to use the application. Most participants agreed or strongly agreed that they would recommend the application to a friend. Some participants were "Neutral" and two disagreed. Many participants were "Neutral" in terms of "needing" to use the application

and the same number either disagreed or strongly disagreed. However, some participants agreed that they needed to use the application. Half the participants either strongly agreed or agreed that they wanted their friends to know that they used the application. Most of the rest of the participants were "Neutral", however some disagreed or strongly disagreed. The responses of the users to the statement "I am happy for the application to make posts to my wall" indicate that although the biggest group of participants agreed or strongly agreed, many disagreed or strongly disagreed and some were "Neutral". As mentioned in Section 4.2.4.6, it was expected that many users would not want the application to post to their wall and the users were therefore given an option.

These results show that although the participants had a positive experiences of the application, most participants were not interested in continuing to use the application. However, the participants were willing to recommend the application to friends. This means that the application has the potential to attract new users however more work is required to retain existing users.

5.3.3 Competition within the Application

Competition was chosen as the motivating factor to encourage user contributions. Users are awarded points for their contributions and are placed on a leaderboard according to their score. The more competitive the users are, the more likely it is that they will contribute and the more able the application is at collecting pictures, tags and metadata. Therefore, understanding how competitive the users are within the application will help to answer research questions 1, 2 and 3.

Figure 5.9 shows the percentage of participants (y-axis on the left) who reported wanting to beat their friends' scores, or other users' scores as well as the percentage of participants (y-axis on the right) who answered "Yes" to knowing their position on the friend leaderboard and the main leaderboard. The majority of participants reported wanting to beat their friends' scores (80%) and users' scores (67%) with most of these participants wanting to beat both. More participants reported wanting to beat their friends scores than wanting to beat other users' scores. However, only 30% of participants knew their position on the friend leaderboard. In comparison, 97% of participants knew their position on the main leaderboard. This inconsistency is probably a result of the mini-leaderboard showing the users' position on the main leaderboard and not on the friend leaderboard. Given that more participants are interested in beating their friends' scores, it may be beneficial

to have the friend leaderboard (or both leaderboards) displayed in the mini-leaderboard.

These results indicate that users are competitive within the system and that the leaderboard is successful at showing the users their position and encouraging competition. However, as more users are motivated to beat their friends' scores over other players' scores, it would be beneficial to make the friend leaderboard more visible to users.

Competitive Nature of Participants

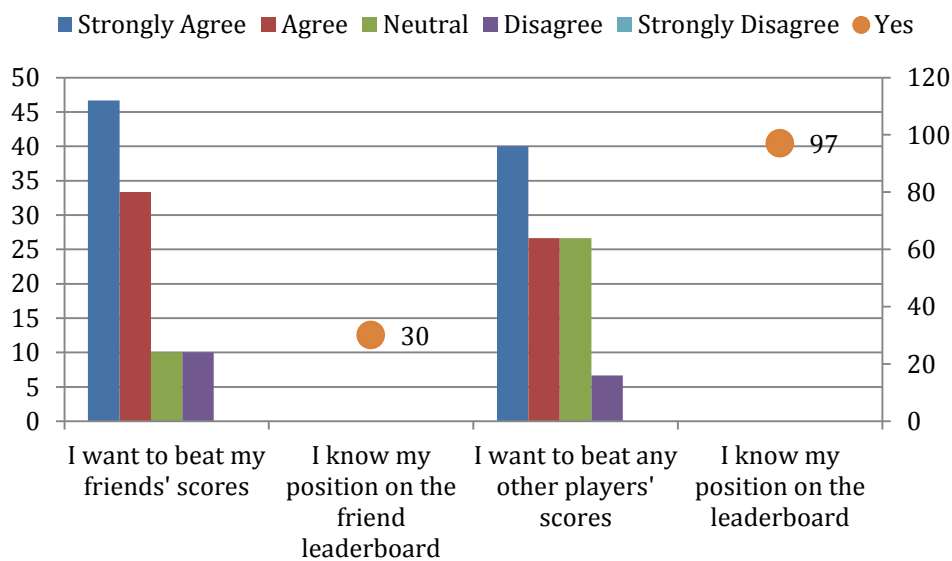


FIGURE 5.9: COMPETITIVE NATURE OF PARTICIPANTS

In the survey, participants were asked if they continued to use the application after completing the required tasks. If the participants responded "Yes", the participant was asked if he/she had contributed pictures, tags or picture information in order to improve his/her score on the leaderboard. Most participants (73%) reported that they continued to use the application after completing the required tasks. Figure 5.10, shows the percentage of users who contributed pictures, tags and picture information in order to improve their score on the leaderboard. A percentage of both the total participants as well as a percentage of only continuing users is shown. The percentage of total users is displayed on the left, whereas the percentage of continuing users is shown on the right. The majority of participants contributed pictures and tags in order to improve their score. However, fewer users contributed picture information in order to improve their score.

These results show that users are motivated by the leaderboard to contribute pictures. However the results also indicate that the users are possibly unaware that adding picture information can improve their score. More contributions of picture information may be possible by successfully communicating this with users.

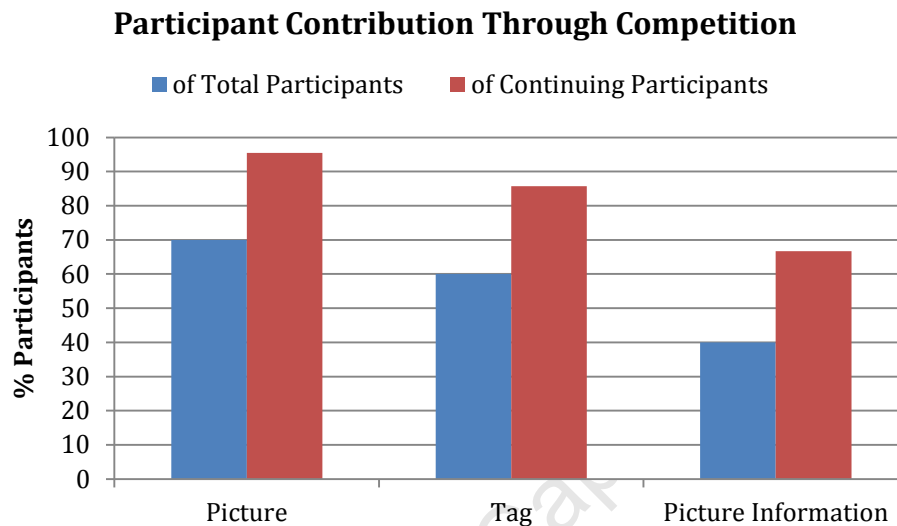


FIGURE 5.10: PARTICIPANT CONTRIBUTION THROUGH COMPETITION

5.3.4 Application Usage and Data Collected

Actual usage of the system will show to what extent the application is able to collect pictures, tags and metadata, therefore answering research questions 1 and 2.

5.3.4.1 Usage

Although the final evaluation survey had thirty participants, there were other users of the application. Some users added the application during the first and second evaluation phases discussed in Section 4.1. Others found the application through the social network.

As of 10 March 2012, the application had 101 users, 314 pictures and 736 tags. The 314 pictures were uploaded by 56 of the 101 users. This gives an average of 3.1 pictures each for all the application users, or an average of 5.6 pictures each for all contributing users. Of the 314 pictures contributed, 265 had a title, 78 had a description, 72 had an attribution, 266 had a licence and 275 had at least 1 tag. On average pictures had 2.3 tags each, however if only

the pictures with at least 1 tag are taken into account, the average is 2.7 tags per picture. The 736 tags had 430 distinct keywords.

These results show that users are adding the application and contributing pictures, tags and metadata.

5.3.4.2 Types of Heritage Collected

Participants were asked to indicate which type of heritage they were interested in. Table 5.1 lists the heritage genres in descending order of popularity among participants. The percentage of participants interested in these genres is also given. Participants were allowed to indicate as many genres as they were interested in. On average, participants indicated being interested in 3.5 of the genres. At least half of the participants were interested in both country heritage as well as nature heritage. Three participants were only interested in one genre and one participant was interested in eight genres. Country heritage was the most popular, followed narrowly by nature heritage. These results were consistent with the actual tags added by users. Table 5.2, shows five of the most popular tags as well as the number of times they were used as of 10 March 2012. "Cape Town" was the most popular tag and was used 50 times. "South Africa" was second with 22 tags, "Angola" third with 20 tags and "Mountain" fourth with 18 tags. "Nature" and "Beach" shared fifth place and were each tagged 13 times.

TABLE 5.1: PARTICIPANT INTEREST IN HERITAGE GENRES

Genre	% of Participants
Country	53
Nature	50
History	43
Family	40
Cultural	37
Religion	30
Community	27
Other	10

TABLE 5.2: THE MOST POPULAR TAGS IN THE TAGCLOUD

Tag	Number of Times Used
"Cape Town"	50
"South Africa"	22
"Angola"	20
"Mountain"	18
"Nature", "Beach"	13

5.4 SUMMARY

The aim of this research was to create a Facebook application for the purpose of collecting heritage data, specifically pictures and answer the following research questions: 1) How effective is the application on a social network at building heritage collections? 2) How effective is the application on a social network at labelling, heritage collections with metadata and tags? 3) How can users be motivated to contribute to the collection? The application was evaluated in terms of user experience, motivation (specifically competition within the application) and actual usage. Evaluation of the application by these factors was necessary in order to answer the research questions. Evaluation took the form of survey. Participants were asked to complete a task list before answering the survey. The tasks included adding the application and contributing pictures, tags and metadata.

It was found that direct competition was more effective at motivating user participation than a badge system. The results of the evaluation indicate that the final application has the ability to attract new users. Users have a positive experience of the application in general as well as in terms of adding pictures, tags and metadata. The leaderboard successfully creates competition within the application. Users are motivated by this competition to contribute pictures and to a lesser extent metadata and tags as well. Although users had a positive experience of the application and were willing to recommend the application to friends, the users were not as interested in continuing to use the application. This indicates that the application may not be able to retain existing users. Users found country and nature heritage the most interesting and were more likely to contribute pictures and tags on these topics than on any other topic.

Conclusions based on these results as well as answers to the research questions will now be provided in the Conclusion Chapter.

Conclusion

Collecting heritage into digital libraries is a costly, time consuming process. The purpose of this project was to propose an alternative method of collecting heritage data that would not be as costly as current methods. The proposed solution was to create a Facebook application that would motivate users to contribute and label heritage pictures. A Facebook application was created, which allowed users to share pictures related to heritage as well as to contribute metadata and tags for the pictures. The users could also search and browse through the tags and view all pictures in the gallery. In order to motivate users to contribute, each contribution by the user was rewarded with points that would improve the user's position on a leaderboard.

In order to determine if this method is effective, it is necessary to answer the following research questions: 1) How effective is the application on a social network at building heritage collections? 2) How effective is the application on a social network at labelling, heritage collections with metadata and tags? 3) How can users be motivated to contribute to the collection? An evaluation of the application was conducted in order to answer these questions. In this chapter the research questions will be answered and key contributions, significance of the research as well as future works will be discussed.

6.1 RESEARCH QUESTIONS

The evaluation process analyzed statistics from the survey as well as from the database. These findings provide useful indicators in answering the research questions.

1) How effective is the application on a social network at building heritage collections?

The application has so far collected 314 heritage pictures. Participants of the evaluation survey reported a positive user experience to contributing pictures. The application successfully motivates user contribution of pictures through competition. Therefore the application is effective at building a heritage collection.

2) How effective is the application on a social network at labelling heritage collections with metadata and tags?

For the 314 heritage pictures, the application has so far collected 736 tags as well as 716 metadata items. Results show a positive user experience to adding metadata and tags. Although users are not as motivated to add metadata and tags as they are to add pictures, users do report some motivation. Therefore the application is effective at labelling the collection with metadata and tags.

3) How can users be motivated to contribute to the collection?

Motivation through competition using scores and a leaderboard was found to be more effective than a non-competitive approach using badges. Users reported being motivated to contribute in order to beat both their friends' scores as well as other players' scores.

6.2 SIGNIFICANCE

This research can be applied to other domains where the public or a community has information, content, knowledge or skills that are useful in solving a particular problem. Although it is not the only solution available, it is an option that should not be discarded but should be considered. However, where the public or specific targeted community does not have the information, content, knowledge or skills needed, this method would not be as effective.

Changes in Facebook's API and documentation may indicate that it is not a stable platform. For long term, ongoing projects it may not be suitable to use

Facebook for such an application. However, for short term or once-off projects Facebook may be sufficient. The solution offered by this research is not, however, a one software tool solution, but may be used on other platforms or as part of a broader repository system as described in Section 6.5 below.

6.3 LIMITATIONS

This approach of creating digital heritage collections is limited to situations where the public or a community has information, content or knowledge that is useful or relevant to the collection being created. It therefore should not be seen as a technique which will replace traditional approaches but rather augment them. As mentioned above, Facebook's APIs are unstable and ever-changing. Therefore, such an application, implemented on a Facebook platform, is limited in terms of its potential lifespan.

6.4 KEY CONTRIBUTIONS

This research finds that direct competition is more effective than a non-competition approach. This finding is useful not only within the context of this research but may be applied in other contexts where motivation techniques are needed, for example in games, work environments or education. It is possible that given the context and community, competition may not always be appropriate. However, competition has shown itself to be worthwhile for consideration. For example, in a developing country, specifically an African country with an Ubuntu²⁹ philosophy, it may be assumed that community and collaboration would be favoured over direct competition. However, the results of this research indicate otherwise. Most of the participants of Evaluation 2 (see Section 4.1.3 and Section 5.3.1) were born and/or grew up in an African country. However, the participants reported being more motivated by direct competition than by a non-competitive, collaborative approach.

Through this research, an alternative method to heritage collection was found. In appropriate domains, where the required content of the intended collection is owned or accessible by the public or a community, it is possible to motivate the public or community to contribute to the collection. This method can be

²⁹ Ubuntu directly translates to "humanness". However, the deeper meaning is regarded as difficult to define. According to former South African president, Nelson Mandela, one aspect of Ubuntu is giving a traveller food without him needing to ask or enabling your community to improve. Liberian peace activist, Leymah Gbowee, defines Ubuntu as: "I am what I am because of who we all are".

extended beyond heritage collections, Facebook or even social networks as will be suggested in the Section 6.5 below.

6.5 FUTURE WORK

This research concludes that it is possible to build heritage collections by using Facebook applications to motivate user contribution. The application created through this research successfully collected heritage pictures as well as metadata and tagging for the pictures. However, it is possible to improve on the efficiency of the application. For example, by creating more motivation for users to continue to use the application, the application could improve in terms of user retention; this in turn would increase the application's ability to collect pictures, tags and metadata. In addition, the results indicated that although users were motivated to contribute pictures to improve their scores, they did not seem aware that contributions of tags and metadata would also improve their score. For this reason, contributions may increase if this is communicated to users. This may be possible by taking the users through a tutorial when they first add the application. The users were also clearly more interested in heritage related to countries and nature than other topics of heritage. It may be useful to market the application in terms of these specific topics.

Different ranking methods should be compared in order to achieve the best possible motivation for users. Progress bars, levels, tasks and quests may also be used to motivate through competition. Other motivation approaches may be compared, for example combining competition and collaboration by either creating team based competition or rewarding collaboration with points.

The approach used in this research is not limited to a standalone software tool but can be part of a broader repository:

- A system can be built to integrate with a repository. Content can be collected automatically using SWORD³⁰ (Simple Web-service Offering Repository Deposit) to submit remotely, bridging the gap between social network and repository. For example, taking a picture on a mobile phone and uploading it to a social network could directly send the picture to a repository.
- Where a social network solution is limited to members of the social network, it may be interesting to find ways to access people who are not on such networks. For example, the elderly are important for

³⁰ <http://swordapp.org/>

collecting family heritage and family tree information; however they rarely have Facebook accounts. In these situations, it may be useful to create a new social network, designed for a specific community and purpose.

- Social networks and repository may be interconnected in other interesting ways and architectures. For example, the social network can be brought into the repository. This can be achieved either by making social network concepts available on the repository, or perhaps creating a social repository.

The method used in this research may be applied to other human intelligence tasks. Possible applications are, for example, motivating users to transcribe handwriting of historical documents, to identify people or objects in photographs, to translate texts, to categorise information or to provide metadata for a collection that already exists. Another possible application is a game or competition that would motivate users to participate in developing open source software. Users could try to outperform their peers by creating better systems or algorithms.

Instead of task related applications, it may also be possible to use the method for education or health applications, for example, motivating learning by getting users to practice literacy, algebra or general knowledge. It may even be possible to motivate users to learn the skill of searching for, analyzing and applying information. The sickly, for example those with chronic diseases, may be motivated to take medication, monitor their health, do exercise and eat healthily through such an application.

References

Allen, L., Seeney, M., Boyle, L. & Hancock, F., 2009. The Implementation of Team Based Assessment in Serious Games. In *Conference in Games and Virtual Worlds for Serious Applications*. IEEE. pp.28-35. DOI=10.1109/VS-GAMES.2009.12.

Aluka, 2010. [Online] Available at: <http://www.aluka.org> [Accessed 4 August 2010].

Amato, G. et al., 2006. Using MILOS to Build a Multimedia Digital Library Application: The PhotoBook Experience. In Gonzalo, J., Thanos, C., Verdejo, M. & Carrasco, R., eds. *Proceedings of the 10th European conference on Research and Advanced Technology for Digital Libraries (ECDL'06)*. Berlin, Heidelberg. Springer-Verlag. pp.379-390. DOI=10.1007/11863878_32 http://dx.doi.org/10.1007/11863878_32.

Amazon MTurk, 2011. [Online] Available at: <https://www.mturk.com> [Accessed 25 November 2011].

Andrew Mellon Foundation, 1997. *Summary of Grants and Contributions*. [Online] Available at: http://www.mellon.org/news_publications/annual-reports-essays/grants [Accessed 28 April 2010].

Andrew Mellon Foundation, 1998. *Summary of Grants and Contributions*. [Online] Available at: http://www.mellon.org/news_publications/annual-reports-essays/grants [Accessed 28 April 2010].

Antin, J. & Churchill, E., 2011. Badges in Social Media: A Social Psychological Perspective. In *Proceedings of the 2011 annual conference extended abstracts on Human factors in computing systems (CHI EA '11)*. Vancouver, BC, Canada.

Attia, A., Aziz, N., Friedman, B. & Elhusseiny, M., 2011. Commentary: The impact of social networking tools on political change in Egypt's "Revolution 2.0". *Electronic Commerce Research and Applications*, 10(4), pp.369-374. DOI=10.1016/j.elerap.2011.05.003 <http://dx.doi.org/10.1016/j.elerap.2011.05.003>.

AWS, 2012a. *Amazon Web Services*. [Online] Available at: <http://aws.amazon.com/> [Accessed 21 February 2012].

AWS, 2012b. *Amazon S3 Growth for 2011*. [Online] Available at: <http://aws.typepad.com/aws/2012/01/amazon-s3-growth-for-2011-now-762-billion-objects.html> [Accessed 24 February 2012].

- Bell, R. & Koren, Y., 2007. Lessons from the Netflix prize challenge. *SIGKDD Explore Newsletter*, 9(2), pp.75-79. DOI=10.1145/1345448.1345465
<http://doi.acm.org/10.1145/1345448.1345465>.
- Benkler, Y., 2006. *The Wealth of Networks*. Yale University Press.
- Bischoff, K., Firan, C., Nejdil, W. & Paiu, R., 2009. How do you feel about "dancing queen"?: deriving mood & theme annotations from user tags. In *Proceedings of the 9th ACM/IEEE-CS joint conference on Digital libraries (JCDL '09)*. New York, NY, USA. ACM. pp.285-294. DOI=10.1145/1555400.1555448
<http://doi.acm.org/10.1145/1555400.1555448>.
- Boyd, D. & Ellison, N., 2007. *Journal of Computer-Mediated Communication*, 13(1), pp.210-30.
- Casey, S., Kirman, B. & Rowland, D., 2007. The gopher game: a social, mobile, locative game with user generated content and peer review. In *International Conference on Advances in Computer Entertainment Technology (ACE '07)*. Salzburg, Austria. ACM, New York, NY. pp.9-16.
DOI=10.1145/1255047.1255050.
- Cesar, P. et al., 2008. Enhancing social sharing of videos: fragment, annotate, enrich, and share. In *Proceedings of the 16th ACM international conference on Multimedia (MM '08)*. New York, NY, USA. ACM. pp.11-20.
DOI=10.1145/1459359.1459362
<http://doi.acm.org/10.1145/1459359.1459362>.
- Chen, W. & Nottveit, T., 2010. Digital Map Application for Historical Photos. In Chowdhury, G., Koo, C. & Hunter, J., eds. *Proceedings of the role of digital libraries in a time of global change, and 12th international conference on Asia-Pacific digital libraries (ICADL'10)*. Berlin, Heidelberg. Springer-Verlag. pp.158-67.
- Chittaro, L. & Ranon, R., 2009. Serious Games for Training Occupants of a Building in Personal Fire Safety Skills. In *Games and Virtual Worlds for Serious Applications (VS-GAMES '09)*. pp.76-83. DOI=10.1109/VS-GAMES.2009.8
<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5116556&isnumber=5116538>.
- Concordia, C., Gradmann, S. & Siebinga, S., 2010. Not just another portal, not just another digital library: A portrait of Europeana as an application program interface. *IFLA Journal*, 36, pp.61-69. DOI=10.1177/0340035209360764.

- Davis, P. & Connolly, M., 2007. Evaluating the Reasons for Non-use of Cornell University's Installation of DSpace. *D-Lib Magazine*, 13(3/4).
- Deterding, S., Khaled, R., Nacke, L. & Dixon, D., 2011b. Gamification: Toward a Definition. In *Proceedings of the 2011 annual conference extended abstracts on Human factors in computing systems (CHI EA '11)*. Vancouver, BC, Canada.
- Deterding, S. et al., 2011a. Gamification. using game-design elements in non-gaming contexts. In *Proceedings of the 2011 annual conference extended abstracts on Human factors in computing systems (CHI EA '11)*. New York, NY, USA. ACM. pp.2425-2428. DOI=10.1145/1979482.1979575 <http://doi.acm.org/10.1145/1979482.1979575>.
- Disa, 2010. [Online] Available at: <http://www.disa.ukzn.ac.za/> [Accessed 4 August 2010].
- Django, 2012. *Django Project*. [Online] Available at: <https://www.djangoproject.com/> [Accessed 24 February 2012].
- Djaouti, D. et al., 2009. Serious Games & Cultural Heritage: A Case Study of Prehistoric Caves. In *Virtual Systems and Multimedia (VSMM '09) 15th International Conference*. pp.221-226. DOI=10.1109/VSMM.2009.40.
- Europeana, 2012. [Online] Available at: <http://www.europeana.eu/> [Accessed 17 February 2012].
- Facebook, 2012a. *Newsroom*. [Online] Available at: <http://newsroom.fb.com/> [Accessed 22 March 2012].
- Facebook, 2012b. *Developers*. [Online] Available at: <http://developers.facebook.com> [Accessed 24 February 2012].
- Fox, E., McMillan, G. & Eaton, J., 1999. The evolving genre of electronic theses and dissertations. In *Proceedings of the 32nd Hawaii International Conference on Systems Sciences (HICSS-32)*. Maui, Hawaii. IEEE. p.DOI=10.1109/HICSS.1999.772646 <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=772646&isnumber=16782>.
- Google Books, 2011. *Google Books*. [Online] Available at: <http://books.google.co.za/> [Accessed 22 November 2011].
- Greenstein, D. & Thorin, S., 2002. *The Digital Library: A Biography*. Washington, D.C.: Digital Library Federation, Council on Library and Information Resources.

Grimmelmann, J., 2009. The Google Book Search settlement: Ends, means, and the future of books. Washington, DC. American Constitution Society.

Guthrie, K. & Nygren, T., 2007. *Aluka: Building A Digital Library Of Scholarly Resources From Africa*. [Online] Available at: <http://tsden.aluka.org/fsi/img/misc/pdf/Background.pdf> [Accessed 17 February 2012].

Holley, R., 2010. Crowdsourcing: How and Why Should Libraries Do It? *D-Lib Magazine*, 16(3/4).

Holovaty, A. & Kaplan-Moss, J., 2009. *The Definitive Guide to Django: Web Development Done Right*. 2nd ed. Berkely, CA, USA.: Apress.

Hulme, T., 2011. Open Innovation and Crowdsourcing from IDEO. In *Brisbane Festival of Ideas*. Brisbane, Australia. ABC Radio National.

Järvinen, A., 2009a. Game design for social networks: interaction design for playful dispositions. In Spencer, S.N., ed. *Proceedings of the 2009 ACM SIGGRAPH Symposium on Video Games (Sandbox '09)*. New York, NY, USA. ACM. pp.95-102. DOI=10.1145/1581073.1581088 <http://doi.acm.org/10.1145/1581073.1581088>.

Järvinen, A., 2009b. Workshop: game design for social networks. In *Proceedings of the 13th International MindTrek Conference: Everyday Life in the Ubiquitous Era (MindTrek '09)*. New York, NY, USA. ACM. pp.224-225. DOI=10.1145/1621841.1621889 <http://doi.acm.org/10.1145/1621841.1621889>.

JSTOR, 2011. [Online] Available at: JSTOR. <http://www.jstor.org/> [Accessed 22 November 2011].

Khatib, F. et al., 2011. Crystal structure of a monomeric retroviral protease solved by protein folding game players. *Nature Structural & Molecular Biology*, 18, p.1175–1177. DOI=10.1038/nsmb.2119 <http://www.nature.com/nsmb/journal/v18/n10/full/nsmb.2119.html>.

Kirman, B., Lawson, S. & Linehan, C., 2009. Gaming On and Off the Social Graph: The Social Structure of Facebook Games. In *International Conference on Computational Science and Engineering (CSE '09)*. IEEE. pp.4:627-632. DOI=10.1109/CSE.2009.266.

Kittur, A., Chi, E. & Suh, B., 2008. Crowdsourcing user studies with Mechanical Turk. In *Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems (CHI '08)*. New York, NY, USA. ACM. pp.453-456.

DOI=10.1145/1357054.1357127

<http://doi.acm.org/10.1145/1357054.1357127>.

Kollock, P., 1999. The Economies of Online Cooperation: Gifts and Public Goods in Cyberspace. In M.A. Smith & P. Kollock, eds. *Communities in cyberspace*. Routledge.

Krueger, R. & Casey, M., 2009. *Focus Groups: A Practical Guide for Applied Research*. 4th ed. SAGE.

Lagoze, C. et al., 2002. Core services in the architecture of the national science digital library (NSDL). In *Proceedings of the 2nd ACM/IEEE-CS joint conference on Digital libraries (JCDL '02)*. New York, NY, USA. ACM. pp.201-209.

DOI=10.1145/544220.544264 <http://doi.acm.org/10.1145/544220.544264>.

Lagoze, C., Payette, S., Shin, E. & Wilper, C., 2006. Fedora: An Architecture for Complex Objects and Their Relationships. *International Journal on Digital Libraries*, 6(2), pp.124-138. DOI=10.1007/s00799-005-0130-3 <http://dx.doi.org/10.1007/s00799-005-0130-3>.

Lund, A., 2001. Measuring Usability with the USE Questionnaire. *STC Usability SIG Newslette*, 8(2).

Marmor, M., 2003. ArtSTOR. *Journal of Library Administration*, 39(2-3), pp.61-68. http://dx.doi.org/10.1300/J111v39n02_06.

Mayer, A., 2009. Online social networks in economics. *Decision Support Systems*, 47(3), p.169-184.

Mikovec, Z., Slavik, P. & Zara, J., 2009. Cultural Heritage, User Interfaces and Serious Games at CTU Prague. In *Virtual Systems and Multimedia (VSMM '09)*. pp.211-216. DOI=10.1109/VSM.2009.38.

Netflix, 2009. *Netflix Prize*. [Online] Available at: <http://www.netflixprize.com> [Accessed 25 November 2011].

OpenIDEO, 2011. *OpenIDEO*. [Online] Available at: <http://www.openideo.com/> [Accessed 28 November 2011].

Ossmann, R. & Miesenberge, K., 2010. Accessibility of a social network game. In Miesenberger, K., Klaus, J., Zagler, W. & Karshmer, A., eds. *Proceedings of the 12th international conference on Computers helping people with special needs: Part I (ICCHP'10)*. Berlin, Heidelberg. Springer-Verlag. pp.243-46.

- Palmer, K., Dill, E. & Christie, C., 2009. Where there's a will there's a way?: Survey of academic librarian attitudes about open access. *College & Research Libraries*, 70(4), p.315–335.
- Pepe, A. et al., 2005. CERN Document Server Software: The Integrated Digital Library. In *9th ICCO International Conference on Electronic Publishing*. Leuven, Belgium. pp.297-302.
- reCAPTCHA, 2010. [Online] Available at: <http://recaptcha.net/> [Accessed 3 May 2010].
- Rogstadius, J. et al., 2011. An Assessment of Intrinsic and Extrinsic Motivation on Task Performance in Crowdsourcing Markets. In *Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media (ICWSM'11)*. Barcelona, Catalonia, Spain. AAAI Press.
- Ross, J. et al., 2010. Who are the crowdworkers?: shifting demographics in mechanical turk. In *Proceedings of the 28th of the international conference extended abstracts on Human factors in computing systems (CHI EA '10)*. New York, NY, USA. ACM. pp.2863-2872. DOI=10.1145/1753846.1753873 <http://doi.acm.org/10.1145/1753846.1753873>.
- Shin, D. & Shin, Y., 2011. Why do people play social network games? *Computers in Human Behavior*, 27(2), pp.852-861. DOI=10.1016/j.chb.2010.11.010 <http://dx.doi.org/10.1016/j.chb.2010.11.010>.
- Signific Lab, 2010. [Online] Available at: <http://play.signific.org/node/1> [Accessed 5 August 2010].
- Smith, M. et al., 2003. DSpace: An Open Source Dynamic Digital Repository. *D-Lib Magazine*, 9(1).
- Springer, M. et al., 2008. *For the Common Good: The Library of Congress Flickr Pilot Project*. Technical Report. Library of Congress.
- Starbird, K., 2011. Digital Volunteerism During Disaster: Crowdsourcing Information Processing. In *Workshop on Crowdsourcing and Human Computation: Systems, Studies and Platforms (CHI'11)*. Vancouver, BC, Canada.
- Suleman, H., 2007. Digital Libraries Without Databases: The Bleek and Lloyd Collection. In Kovacs, L., Fuhr, N. & Meghini, C., eds. *Proceedings of Research and Advanced Technology for Digital Libraries (ECDL'07)*. 11th European Conference. Budapest, Hungary. pp.392-403.

- Suleman, H., 2008. An African Perspective on Digital Preservation. In *Post-Proceedings of International Workshop on Digital Preservation of Heritage and Research Issues in Archiving and Retrieval*. Kolkata, India.
- Sung, J., Bjornrud, T., Lee, Y. & Yvette Wohn, D., 2010. Social network games: exploring audience traits. In *Proceedings of the 28th of the international conference extended abstracts on Human factors in computing systems (CHI EA '10)*. New York, NY, USA. ACM. pp.3649-3654.
DOI=10.1145/1753846.1754033.
- The Lord of the Rings: The Fellowship of the Ring*. 2001. [Film] Directed by Peter Jackson. New Zealand: New Line Cinema.
- Tsolis, D., Tsolis, G., Karatzas, E. & Papatheodorou, T., 2001. Copyright Protection and Management and a Web Based Library for Digital Images of the Hellenic Cultural Heritage. In *Proceedings of the 2001 Conference on Virtual Reality, Archeology, and Cultural Heritage (VAST '01)*. New York, NY, USA. ACM. pp.53-60. DOI=10.1145/584993.585002
<http://doi.acm.org/10.1145/584993.585002>.
- UNESCO, 2003. *Charter on the Preservation of the Digital Heritage*. [Online] Available at:
http://portal.unesco.org/ci/en/files/13367/10700115911Charter_en.pdf/Charter_en.pdf [Accessed 22 April 2010].
- Vise, D., 2008. *The Google Story*. New York: Bantam Dell, Random House Inc.
- von Ahn, L. & Dabbish, L., 2004. Labelling Images with a Computer Game. In *ACM Conference on Human Factors in Computing Systems (CHI '04)*. pp.319-26.
- von Ahn, L., Liu, R. & Blum, M., 2006. Peekaboom: a game for locating objects in images. In *Proceedings of the SIGCHI conference on Human factors in computing systems (CHI '06)*. Montréal, Canada. ACM Press, New York, NY, USA. p.55-64.
- Wikipedia, 2011. *About*. [Online] Available at:
<http://en.wikipedia.org/w/index.php?title=Wikipedia:About/> [Accessed 25 November 2011].
- Witten, I. & Bainbridge, D., 2007. A retrospective look at Greenstone: lessons from the first decade. In *Proceedings of 7th ACM/IEEE-CS joint conference on Digital libraries (JCDL '07)*. New York, NY, USA. ACM. pp.147-156.
DOI=10.1145/1255175.1255204
<http://doi.acm.org/10.1145/1255175.1255204>.

Witten, I., Bainbridge, D. & Nichols, D., 2010. *How to Build a Digital Library*. San Francisco, CA: Morgan Kaufmann.

Yvette Wohn, D., Lee, Y., Sung, J. & Bjornrud, T., 2010. Building common ground and reciprocity through social network games. In *Proceedings of the 28th of the international conference extended abstracts on Human factors in computing systems (CHI EA '10)*. New York, NY, USA. ACM. pp.4423-4428. DOI=10.1145/1753846.1754164
<http://doi.acm.org/10.1145/1753846.1754164>.

Zara, J., 2004. Virtual Reality and Cultural Heritage on the Web. In *Proceedings of the 7th International Conference on Computer Graphics and Artificial Intelligence*. pp.101-12.

Zhou, Y., Wilkinson, D., Schreiber, R. & Pan, R., 2008. Large-Scale Parallel Collaborative Filtering for the Netflix Prize. In Fleischer, R. & Xu, J., eds. *Proceedings of the 4th international conference on Algorithmic Aspects in Information and Management (AAIM '08)*. Berlin, Heidelberg. Springer-Verlag. pp.337-348. DOI=10.1007/978-3-540-68880-8_32
http://dx.doi.org/10.1007/978-3-540-68880-8_32.

Zynga, 2011. *About*. [Online] Available at: <http://company.zynga.com/about/> [Accessed 24 November 2011].

Appendix – Survey Questions

Collecting Heritage - Facebook Application

This survey aims to test the ability of a Facebook application at collecting heritage images

Informed Consent

* I1:

Given the nature of social networks, your use of the applications will not be anonymous as it is linked to your Facebook profile.

Terms of participating in this survey:

- Use of this application will be public given the nature of social networks.
- The researcher has permission to use the data obtained from this evaluation session.
- The researcher cannot use or give to a third party any of the participant's personal information.
- Payment will only be made if and only if:
 1. the tasks have been completed (this can be confirmed by the researcher) AND
 2. the survey has been satisfactorily completed AND
 3. name and contact details are provided AND
 4. you have contacted the researcher and have an agreement with the researcher to proceed

I understand and agree to these terms and I freely choose to participate in this survey.

Please choose *all* that apply:

I Agree

Contact Details

This information is required for payment purposes only.

If you would like to complete this survey and do not expect payment, please feel free to ignore this section.

C1: Name:

Please write your answer here:

C2: Phone Number:

Please write your answer here:

C3: Email Address:

Please write your answer here:

Functions (Pictures)

For each of the following functions, please answer the questions below

* **F1: Viewing Pictures**

Do you agree or disagree about the function to view pictures?

Please choose the appropriate response for each item:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I found this function easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It could be useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It does everything I would expect it to do	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can use it successfully every time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is fun to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It works the way I want it to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*** F2: Adding a Picture**

Do you agree or disagree with about the function to **add pictures**?

Please choose the appropriate response for each item:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I found this function easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It could be useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It does everything I would expect it to do	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can use it successfully every time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is fun to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It works the way I want it to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

F9: Do you have any additional comments to the questions above?

Functions (Information)

*** F4: Editing Information on Pictures**

Do you agree or disagree about the function to edit information on pictures?

Please choose the appropriate response for each item:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I found this function easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It could be useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It does everything I would expect it to do	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can use it successfully every time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is fun to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It works the way I want it to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*** F5: Viewing Information on Pictures**

Do you agree or disagree about the function to view information on pictures?

Please choose the appropriate response for each item:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I found this function easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It could be useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It does everything I would expect it to do	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can use it successfully every time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is fun to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It works the way I want it to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

F10: Do you have any additional comments to the questions above?

Functions (Tags)

*** F6: Adding a Tag**

Do you agree or disagree about the function to **add a tag**?

Please choose the appropriate response for each item:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I found this function easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It could be useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It does everything I would expect it to do	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can use it successfully every time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is fun to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It works the way I want it to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*** F7: Browsing the Tag Cloud**

Do you agree or disagree about the **tag cloud** function?

* A "Tag Cloud" is a visual representation of words. The bigger the words, the more often they are used. The tag cloud in this application is the group of words on the bottom left of the page. Please choose the appropriate response for each item:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I found this function easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It could be useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It does everything I would expect it to do	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can use it successfully every time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is fun to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It works the way I want it to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX – Survey Questions

* **F8: Search Box** Do you agree or disagree with about the **search box** function?

* The search box is on the left, below the leaderboard

Please choose the appropriate response for each item:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I found this function easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It could be useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It does everything I would expect it to do	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can use it successfully every time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It is fun to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It works the way I want it to work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

F11: Do you have any additional comments to the questions above?

Social

*** S1: Without looking back at the application...**

Do you know your ranking:

Please choose the appropriate response for each item:

	Y es	No
On the leaderboard	<input type="checkbox"/>	<input type="checkbox"/>
On the friend leaderboard	<input type="checkbox"/>	<input type="checkbox"/>

*** S4: Did you continue to use the application after completing the required tasks?**

Please choose *only one* of the following:

- Yes
 No

[Only answer this question if you answered 'Yes' to question 'S4 ']

*** S5: Did you try to improve your score/rank by contributing one of the following:**

Please choose the appropriate response for each item:

	Yes	No
Picture	<input type="checkbox"/>	<input type="checkbox"/>
Tag	<input type="checkbox"/>	<input type="checkbox"/>
Picture information	<input type="checkbox"/>	<input type="checkbox"/>

*** S3: Do you agree or disagree with the following statements?**

Please choose the appropriate response for each item:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I want to beat my friends' scores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I want to beat any other players' scores	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

General

*** G1: How long have you been using the application?**

Please choose *only one* of the following:

- Less than an hour
- A few hours
- A few days
- A few weeks
- A few months

*** G2: Please choose to what extent you agree or disagree with the following statements**

Please choose the appropriate response for each item:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I will continue to use the application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I will recommend the application to a friend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I need to use the application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I want my friends to know that I use the application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am happy for the application to make posts to my wall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*** G3: Please rate the application according to the following scales:**

Please choose the appropriate response for each item:

Fun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Boring
Practical	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Impractical
Simple	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complicated
Enjoyable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Frustrating
Social	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Non-Social
Effective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ineffective
Inviting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Repelling
Interesting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Disengaging
Clear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Confusing
Easy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Challenging

*** G4: What kind of heritage are you interested in collecting?**

Please choose *all* that apply:

- Cultural
- Family
- Community
- Country
- Nature
- Religion
- History
- Other

G5: Do you have any general comments or suggestions for improvement?

Demographics

*** D1: Age:**

Please choose *only one* of the following:

- 14 or under
 - 15 to 19
 - 20 to 29
 - 30 to 39
 - 40 to 49
 - 50 to 59
 - 60 or over
-

*** D2: Gender**

Please choose *only one* of the following:

- Female
 - Male
-

*** D3: Highest Level of Education:**

Please choose *only one* of the following:

- Less than High School
 - High School
 - Diploma
 - Bachelor's Degree
 - Honour's Degree
 - Master's Degree
 - Doctorate Degree
-

*** D4: Are you a professional or researcher in the fields of Digital Libraries, Library Studies, Archival Studies?**

Please choose *only one* of the following:

- Yes
 - No
-

Submit Your Survey.

Thank you for completing this survey.