TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

ARIS MALAPASCHAS
DESIGN AND EVALUATION OF A PLAYFUL MOBILE
APPLICATION TO FACILITATE GROUP INTERACTION

Master of Science thesis

ABSTRACT

ARIS MALAPASCHAS: Design and Evaluation of a Playful Mobile Application to Facilitate group Interaction
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People are often involved in situations where they are required to interact with a group of strangers. The social interaction in these situations can be hindered by several factors, such as a person's shyness or inhibition, and the lack of common ground. In order to overcome these obstacles, various group activities known as ice-breaking or team-building activities, have been developed and put to use.

Electronic mobile devices with networking capabilities like tablets and smartphones are nowadays used extensively in everyday life. One of their many use cases is to help people socialize, either by meeting new people or communicating with friends. Additionally, video games have been proven efficient in motivating people to socialize, either by inspiring players to form groups and communities over distance, or by facilitating interaction between collocated people.

The main objective of this thesis is to design, implement and evaluate an ice-breaking activity for a group of strangers, utilizing the benefits of mobile technology and video games mentioned above. The result was a quiz-based, multi-player, mobile game called *Who's Next*, built for mobile devices that run the Android operating system. The Wi-Fi Direct framework was used to establish connection and data exchange between the devices.

The thesis was written within the borders of the Human-Technology Interaction research field, using the User-Centered Design methodology. Thus, the thesis begins with a theoretical study on video games and their social impact, and the different social relationships and groups between people. Next, a description of traditional ice-breaking activities and their characteristics is presented. Moreover, previous attempts to utilize technology -and mobile devices in particular- in such activities are explored.

To evaluate the effects of the game as an ice-breaker, a user study with six group sessions of 4 to 5 participants were conducted. The participants' behaviour during the sessions, as well as their feedback given in an interview afterwards, were examined and analyzed to form conclusions about the appropriateness of the game and the players' overall user experience. According to the results, *Who's Next* was found to be an engaging application that encourages social interaction in a group, and which helps strangers get to know each other. Most participants found it preferable to other ice-breaking activities, since it provided more a comfortable way to share their personal information with a group.

PREFACE

My purpose when applying to the Human Technology Interaction programme of Tampere University of Technology was to expand my knowledge in the area of Computer Science, but also to specialize in the emerging and fascinating field of HCI. Through my studies I learned many things, had great experiences and made good friends.

I would like to express my gratitude to my supervisor Thomas Olsson, who was always there to provide his invaluable advice and help, and who showed understanding and patience. I would also like to thank Pradthana Jarusriboonchai who assisted me in completing this thesis, and all the people in Tampere University of Technology who generously provided me with the means to achieve my goals.

Finally, I want to express my thanks to my family for their unconditional support, without which I wouldn't be where I am today. *Ευχαριστώ*.

Tampere, 25.3.2015

Aris Malapaschas

LIST OF SYMBOLS AND ABBREVIATIONS

2D	Two dimensional (often for video games or computer graphics)
API	Application Programming Interface
Database	A comprehensive collection of related data organized for convenient access, generally in a computer
Gameplay	the plot of a computer or video game or the way that it is played[1]
Hard-coding	Embedding input or configuration data directly into the source code of a program[2]
HCI	Human-Computer Interaction
HTI	Human-Technology Interaction
RPG	Role Playing Game
Table (database)	A collection of related data held in a structured format within a database
Tap	Touch screen gesture usually used to select objects on the screen or press virtual buttons
Toast	A simple popup message shown in the screen of Android devices
UI	User Interface
UX	User Experience
WFD	Wi-Fi Direct

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[1] http://dictionary.reference.com/
[2] http://en.wikipedia.org/wiki/Hard_coding

CONTENTS

1.   INTRODUCTION

This thesis was written within the scope of the CoSMo (*Co-Located User Interaction with Social Mobile Devices*) project, conducted by the Unit of Human-Centered Technology (IHTE) of Tampere University of Technology, in 2015. The CoSMo project *studies user needs for proactive, "social mobile devices", as well as implements demonstrators of the concept in various contexts of social interaction*[3]. For the needs of the thesis, a multiplayer mobile game called "*Who's next?*" was implemented, designed to be used as a playful activity in a group of strangers, aiming to break the ice and facilitate social interaction between them. In order to evaluate the impact the game can have in such a context, and to gather feedback about the different design decisions, a user study was conducted, which consisted of six sessions with 4-5 participants each.

This chapter describes the background for the topic of the thesis and introduces the objectives of the research and the implementation. Then, a brief summary of the followed procedure and the used methodology is given. Finally, a picture of how the thesis is structured and what is contained in each chapter is presented.

1.1.   Background and Motivation

Social interaction in a group of strangers can be challenging. Depending mostly on people's character and disposition, some find it difficult to overcome their shyness and insecurity towards a group, in order to initiate communication and engage others in conversation. Additionally, the lack of knowledge of the group's common ground can lead to a lack of interesting discussion topics and motivation to communicate.

Everyday life is full of situations where groups of people who are not familiar with each other are formed, either incidentally or deliberately. This can be the result of a social event like a party, or a meeting of people with common interests like a dance class. In contexts like these, interaction between the group members would be at least beneficial, and sometimes expected or required. It is however inhibited because of the social obstacles mentioned earlier (e.g. shyness or the lack of appropriate discussion topics). The traditional methods used in order to overcome these challenges and '*break the ice*' between the members of the group have been found to be successful e.g. in occasions like work groups (Nasir et al. 2013), but they can often be stressful for the participants who have to introduce themselves to the rest of the group. Moreover, common ice-breaking activities require a timely set-up or a considerable

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[3] http://www.cs.tut.fi/ihte/projects/CoSMo/

physical space in order to be carried out and a dedicated person acting as a facilitator (West 1999). Finally, nowadays the majority of the popular ice-breaking activities may feel obsolete, especially to younger generations. Therefore there is clearly room for further improving these activities, or even exploring different approaches.

In the modern world the vast majority of people in developed countries have daily access to electronic devices with Internet connectivity, such as computers and smartphones. Using social networking platforms such as Facebook and Twitter, or instant messaging services like Whatsapp and Viber, people establish channels of communication with contacts around the world. However, it is debatable whether people have become more social thanks to that particular use of technology, and there is a significant number of phenomena that imply the opposite (Kraut et al. 1998). Cases like a group of friends sitting together and interacting with their smartphones instead of talking to each other are indicative. Mobile technology, however, could serve as a way to encourage face-to-face interaction (Jarusriboonchai et al. 2014). Hence, the thesis consists of an attempt to utilize those benefits that mobile technology can provide, focusing in its socializing aspect,

1.2.   Research Objectives and Methodology

This thesis belongs in the field of Human Computer Interaction (HCI), which aims to research ways to develop computer technology, while focusing on its users' reactions and behaviour. In order to be able to apprehend the users' needs, and interpret the characteristics of the different contexts of using software, a study of the social circumstances in each case is essential.

Since this is a project for an Information Technology programme, the main intention is to create a software application, which will however have the purpose to serve certain user needs. In particular, the thesis examines the notion of using smartphones in ice-breaking activities, in an attempt to introduce a novel and engaging alternative to the existing methods. It aims to find a way to utilize people's familiarity and comfort with sharing personal information via an electronic device, eliminating the several obstacles that social interaction between strangers introduces, which are also present in the traditional ice-breaking activities.

The methodology used to form the final concept of the application is based on the User-Centered Design (UCD) philosophy, which applies human factors (such as user requirements and needs) to enhance effectiveness, efficiency and user satisfaction (ISO 2010). In order to form a final concept of an application to be developed, an iterative design process was conducted, utilizing the UCD methodology by using storyboards and creating prototypes.

Aiming to facilitate social interaction between strangers, the different contexts and conditions in which such encounters can occur were examined.

The result of the approach described above was the development of the playful mobile game *Who's Next*. The purpose of the game is to go beyond the traditional ice-breaking activities in the following ways:

- Help people share their personal information with the group, in a way that doesn't make them feel uncomfortable.
- Provide a motivating, pleasant, and effective way for people to memorize basic information about the others' background and personality.
- Be adjustable in different situations and contexts, and possible to use between groups of people whose familiarity with each other varies (e.g. not just strangers but also friends).
- Provide motivation and reasons to lead to further interaction between people of the group, by uncovering common ground, like common interests and preferences.

An important focus of the thesis is that of User Experience (UX), which is a rather individual aspect that emerges from the user's interaction with the product (Law 2009). Hence, in order to evaluate the effects of the game, and its succes in serving the aforementioned goals, a user study was conducted. The participants' behavior while playing the game was observed and recorder, to analyze their perception of the game's logic, but also to determine what kinds of interaction derived from the game and to what extent. The participants were then interviewed to express their opinion on the game's concept, and their viewpoint about its different features and aspects, and to describe their overall user experience while playing the game.

1.3. Structure of the Thesis

Chapters 2 and 3 further elaborate the research objectives that are briefly described above, by providing a concise study to the relevant theoretical background.

In particular, chapter 2 presents an overview of the modern video games and their evolution through history from an HCI and social perspective. To design and implement an engaging and efficient playful mobile application, delving into the field of video games is important. Hence, chapter 2 emphasizes to the ways in which socialization motivates people to play games, but also how gaming can motivate people to socialize. Additionally, the effects of playing video games on people's behavior on a social level are explored.

Chapter 3 examines the social relationships that are developed among people, highlighting the different phases of social interaction in groups and the obstacles that

may discourage it. This is essential in order to realize what are the factors that inhibit communication between people, and to start envisioning ways to overcome them. Then, the most common methods used to avoid these factors are described, as well as the ways that technology can help towards this direction.

Chapter 4 depicts the methodology and procedure that was followed in order to create the concept of the *Who's Next* game, as well as the reasons behind the different design choices that were made. A thorough explanation of how the application is structured an implemented is finally given.

The objectives and methodology of the evaluating procedure are presented in chapter 5, which also includes a detailed report on the user study sessions and the people who participated.

The results of the user study are summarized in chapter 6, which attempts to interpret the observed participants' behavior and the feedback that they gave in the group discussions.

Finally, chapter 7 discusses the overall contribution of the thesis, and reflects how the research questions and initial objectives are addressed in the developed application. Moreover, it includes an effort to assess the obtained results and to compare the *Who's Next* game with related projects and research.

2.   VIDEO GAMES

Video games are a form of entertainment that has been gaining ground dramatically over the last decades. According to the Entertainment Software Association

[1], 58% of Americans play video games, with an average of two gamers in each game-playing U.S. household, which is indicative of their increasing popularity. It is therefore clear that the role of video games in modern society is extensive, and their potential impact on people significant. Referring to any kind of playful interaction that involves a human player generating input, and an electronic device which generates video feedback, video games come in many forms and genres. Depending on their nature and purpose, video games can accomplish different objectives and can have various effects.

The success of video games as a way to motivate people to perform tasks and solve problems, they have been used in miscellaneous fields, and with very distinctive purpose, such as research and education. The focal point of this chapter, and by extension of the whole thesis, is video games as a means of socializing, whether that means meeting new people, or improving the social bonds and facilitating the interaction between people already familiar with each other.

Regarding the devices (hardware) that are used to play video games, various electronic systems have been used over the years, during which the rate of advancement has been astonishing. In this chapter, the type of games that is covered more broadly is mobile games. This term refers to playful applications designed for mobile devices (i.e. smartphones), and which are differentiated from other games by being more portable, easily accessible, and relatively simple in terms of design and implementation.

The current chapter begins with an overview of the evolution of video games in terms of input methods and interaction between the players. Next, special report is given to games played on mobile devices. Then, the different reasons of why people play video games are analyzed and finally, an attempt to examine the different social impacts of multiplayer games is made.

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[1] http://www.theesa.com/wp-content/uploads/2014/10/ESA_EF_2014.pdf

2.1. Evolution of Video games

There are many viewing angles that can be used to describe the progression of video games. This section focuses on the evolution of games from the human interaction perspective, starting with an overview of the most important input methods that have been implemented, followed by an approach on the interaction between multiple players.

2.1.1. Early Controllers and Input Methods

Electronic games were first introduced to the masses through arcade games, which would usually contain a single game each and had very simple user interfaces. One of the first arcade games was Pong[1], a game that can be described as a 2D tennis, for which the players had to turn a dial to move their '*paddle*' vertically on the screen. The popular game Pac-Man introduced a four-directional joystick, which was later evolved to the eight-directional trackball. Most arcade games however utilized a joystick and one or two action buttons, used for primary gameplay such as '*fire*' or '*jump*'. Due to their significance in video game development, arcade games were the seed for many innovations in game interface design (Saunders and Novak, 2007).

Console systems helped video games expanding into players' homes. Released in 1972, The Magnavox Odyssey[2], was the first console and it was designed for two players each of whom would use a controller with two knobs (one for vertical and one for horizontal movement) to control a square on the television screen. About ten years later, the Atari 2600 used a one-button joystick, introducing the combination of holding a direction and pressing a button. The 8-bit Nintendo Entertainment System (NES) used a controller with four buttons and a D-pad (a four directional cross-shaped button), also featuring the *Zapper Gun[3]*, an additional controller used for the game *Duck Hunt*.

The fifth-generation consoles which supported 3D graphics (Sony PlayStation, Nintendo 64) introduced the *analog stick* (similar to the joystick, but used mostly for navigation in three dimensional environments) and the *rumbling* feature (controller feedback with vibration).

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[1] http://en.wikipedia.org/wiki/Pong
[2] http://en.wikipedia.org/wiki/Magnavox_Odyssey
[3] http://www.nintendo.com/consumer/downloads/wiiZapperTri.pdf

Figure 1.1 *Some of the early methods of input in video games. (a) A pong arcade machine, utilizing 2 rotating dials (source: pong-story.com), (b): the two-knobs controller for the Magnavox Odyssey console (source: ign.com), and (c) the Nintendo Zapper Gun (source: Wikipedia)*

A distinct type of platforms in terms of video games and interface design is the mobile platforms, which has its roots in the 1970s handheld devices. These devices can be organized in three distinct categories: pre-cartridge, which did not utilize external media storage, cartridge-based, which offered the ability to play multiple games by changing cartridges, and the multipurpose handhelds. All three categories used buttons and D-pads for user input. The Nintendo DS[1] was one of the most innovate handheld devices from the user interface perspective, since it used two screens simultaneously, one of which was a touchscreen operated via a stylus. Sony's PlayStation Vita[2] features a touch pad on the back of the device, which can be used to input touch gestures.

One of the most popular mobile gaming platforms nowadays are mobile phones, originally designed for voice communication and later evolved into smartphones. Smartphones have touchscreens, internet connectivity and other features which make

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[1] http://en.wikipedia.org/wiki/Nintendo_DS
[2] http://www.playstation.com/en-us/explore/psvita/

them suitable for games (Saunders and Novak, 2007). A more detailed report on smartphones as gaming machines is given in section 2.2.

2.1.2. Player-to-player Interaction

The evolution of artificial intelligence in video games established the notion of single player games, or games that can feature single-player mode. Early games like Pac-Man and Space Invaders brought popularity to this type of games. Focusing on aspects like engaging stories and characters, single-player games have become the vast majority of video games.

Games in general however, have always been about playing with others. From the very first game tabletop games of ancient times (such as chess and backgammon), interaction between players has been essential. Video games that could be played by two or more players (multiplayer games) were developed from the beginning of the history of games and can be distinguished in two main categories: the ones played by co-located people often using the same device, and those played remotely. Both kinds of multi-player games can be either competitive or collaborative. Games like '*Tennis For Two*' and '*Pong*' enabled two players to compete against each other on the same machine. The latest gaming consoles like Xbox One and PlayStation4 can have up to four controllers connected at the same time, also enabling cooperative play among people that are in the same room.

Regarding the remotely played multiplayer games, the most popular type is the massively multiplayer online game (also known as MMO). MMOs are capable of supporting large numbers of players playing together at the same time, who interact with each other in a virtual world. MMO games can be found for most network-capable platforms, such as PCs, video game consoles or smart phones and other mobile devices. The most successful example of this gaming genre is World of Warcraft[1], or WoW. With more than 7 million subscribers worldwide, and more than 100 million occasional players, WoW created a social phenomenon that exceeded by far the narrow borders of a simple video game. Interaction between players is an essential part of the game: 9 million player guilds have been created since the game was launched, the purpose of which involves cooperation between players to achieve collective goals and in-game objectives (Figure 1.2).

A special category of online games are social network games (SNG), often also called social games. The term refers to games that are played through online social network services (such as Facebook, Google+ etc.), or offer integration with one or more of the networking platforms to some extent. These games mostly offer multiplayer functionality or asynchronous gameplay mechanics. As of today (2015), most social

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[1] http://eu.battle.net/wow/en/

games are implemented as browser games, but a continuously increasing number of them can be found in mobile devices. Typically in a social game, players have to log in using their account from a social network service. This way the game gains access to the players' contacts and activity on that particular network, and usually urges them to invite their friends on the game, or share with them their in-game performance and achievements. SNGs are amongst the most popular games in the world, and include several products with millions of players. Top Eleven Football Manager[1], FarmVille and Dawn of the Dragons are examples of popular social network games. As stated by Shin et al. (2010), social games are a fast growing phenomenon and are emerging as the top application of social network services (SNSs). Unlike causal gaming, where users played alone and titles cost a fee to download, social games are built to be enjoyed and shared with friends through existing social networks and platform like smartphones. However, their study shows that in order to "ensure their continued popularity, SNGs have several challenges to overcome, and user acceptance is probably the most important one. SNG developers need a better understanding of individual perceptions concerning the level of trust and the influence of security on intention to use". Hence, the aspects that motivate people to share their personal information through video games have to be explored further.

Figure 1.2 *Players from the same 'guild' in World of Warcraft posing for a celebrative group photo after successfully cooperating to defeat an AI enemy.*

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[1] http://www.topeleven.com/

2.2.   Video Games Utilizing Features of Mobile Technology

Early mobile phone games were played on feature phones which had displays and processors large and powerful enough to support them. In 1997, the Finnish company Nokia launched a mobile version of the 1970s game Snake[1], one of the most-played video games of all times, which could be found on more than 350 million devices worldwide.

Improvements in technology throughout the 2000s resulted in smartphones, which combined the expanding cell phone network coverage and Internet access, thus being much more amenable to playing games. For example, Coulton et al. (2005) created a mobile application that uses GPRS technology to inform users with the events of English Premier Football League, wherever they are. It also provides the opportunity for the users to play a real-time fantasy football game based on these events, in real time.

Numerous games were developed that utilized the smartphone's hardware features such as the touchscreen, the GPS and the camera. An example of games that use the smartphone's built-in camera are augmented reality games, which combine a real-world environment with computer graphics, to provide a modified view of reality and allow the users to interact with it. Henrysson et al. (2005) created a tennis game for mobile phones, in which players would use the phone's camera to point to markers placed on a table in front them, representing actions or directions. Every time a player pointed his or her phone's camera to one of the markers, the character they controlled in the tennis game shown in their screen, would perform the corresponding action.

Rashid et al. (2006) described the ability of mobile phones to maintain connectivity while moving as an exciting possibility, and used Bluetooth and RFID to suggest mechanisms that "extend the virtual world of traditional video games through location-based information". GPS has been the most popular technology in *location-based mobile games*, which implement a gameplay that progresses and evolves via the player's location and movement. In the educational game *Savannah* (Benford et al. 2004), players use handheld computers with GPS tracking, in order to collaboratively act as lions in a virtual environment.

Other technological means of location tracking have developed as well; Lautamäki and Suomela (2008) created a sample game called Sandman, which was using Bluetooth technology to detect the proximity of the players' phones. In the game, the users were divided in groups and had to chase each other around the room and interact in ways that the game allowed. Also, the pervasive mobile multiplayer game called *The Drop* (Smith et al. 2005) uses a software system that enables a device to locate

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[1] http://en.wikipedia.org/wiki/Snake_%28video_game%29

itself called *Place Lab* (LaMarca et al. 2005). In *The Drop*, players are divided in two teams, and use their mobile devices to hide and find a virtual briefcase in a public place. The Nintendo StreetPass[1] uses the Nintendo 3DS device's internet connection to locate nearby users and allow exchange of data between them.

According to an infographic created by Super Monitoring[2], as of early 2013, 91% of all people on earth own a mobile phone, and 56% of people own a smart phone. Additionally, 80% of the time users spend on their mobile devices is while using mobile applications, and 32% of that time is spent playing mobile games. Therefore, it is safe to conclude that mobile games play a significant role in the evolution of modern society and the forming of social behaviour of current and upcoming generations.

2.3.   Purposes and Objectives of Video Games

There seem to be several reasons related to why people choose to play video games. A very general and broad reason is enjoyment. When people play games, they amuse themselves in several ways: problem solving and overcoming of challenging obstacles can produce feelings of satisfaction and boost their self-esteem; getting away from problems of real life and living temporarily in a virtual world where every day upsetting issues do not exist can be a stress relief; furthermore, the feeling that they are in complete control of their in-game character and the capability to achieve anything possible with relatively small effort, can compensate for the feeling of lost control over their lives. According to Obrist et al. fun is the most important goal for video games. If players do not enjoy the game, they will not play it. "Games create fun by challenging players, often testing out the limits of their memory and performance. Beside challenge, appealing games evoke the players' fantasy and curiosity. It is crucial for a game to be challenging" (2009).

Besides amusement however, games are effectively being used for other purposes, such as education and socialization. According to Lucero and Arrasvuori (2010), playfulness is an approach that can make any activity more enjoyable. The aforementioned authors created the PLEX Cards, which provide a framework aimed to facilitate the design of playful experiences, and were found to be very effective as a source of inspiration for ideas. Different contexts and examples where playfulness has been used as a means of motivation through video games, and where games are used as tools to achieve a certain goal, are described in the following sections.

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[1] https://www.nintendo.com/3ds/features/streetpass
[2] http://www.supermonitoring.com/blog/state-of-mobile-2013-infographic/

2.3.1. Video Games and Education

Video games are being used as motivational and instructional tools for several different knowledge fields and as mechanisms for people to improve different skills. Griffith et al. (1983) conducted an experiment on a group of elementary school students which proved that the visual and motor coordination of players of video games was better than that of non-players in the same group. It is also proven that there is an educational potential in video games, as a means of teaching and learning, utilizing playfulness as a way to engage students in the learning process. De Aguilera and Mendiz (2003) state that "for learning, video games are of unquestionable importance, and can be used [...] at different academic levels. In addition to stimulating motivation, video games are considered very useful in acquiring practical skills, as well as increasing perception and stimulation and developing skills in problem-solving, strategy assessment, media and tools organization and obtaining intelligent answers".

When it comes to education, mobile games seem to have an advantage over conventional video games, since students are more familiar to mobile applications in general. Many students use their smartphones for the majority of their computing tasks. "Mobile applications and games offer instant gratification in the sense that students can download them to their mobile phones almost immediately and show them off to their friends" (Kurkovsky 2009).

2.3.2. Video Games as a Way of Socializing

Multiplayer games can be played simultaneously or asynchronously by many players. Instead of just offering a better gaming experience, multiplayer games can provide social benefits to their players. According to Lenhart et al. (2008), gaming is often a social activity for most teens, and a major component of their social experience. Although playing games online with people they already know is quite common, 27% of teens play with people they first met online, and 23% of them play both with friends or family and people they met online. Additionally, among teens who play games with others online, more than two in five (43%) say the play games online as part of a group or a guild.

However, it is debatable whether people play multiplayer games in order to socialize (e.g. meet new people or interact with their friends), or just because playing with others makes gaming simply for fun. The study of Weibel et al. (2007) attempts to examine whether playing online games against other users leads to different experiences in comparison with playing against computer-controlled opponents. They confirm that "participants who played against a human-controlled opponent reported stronger experiences of presence, flow, and enjoyment. Lo claims (2007) that when

expected interpersonal relations are established, the players' needs for playing online games will be fulfilled, and thus they will tend to continue to support the online game. Nevertheless, regardless of what is the motivation, multiplayer games are effective in facilitating social interaction between players (see next section).

2.4.   Social Impact of Video Games

The general effects of video games have been a matter for numerous debates. It is often argued that video games can benefit players in acquiring or enhancing various abilities, such as the development of observational skills (Brereton et al. 2003), numeracy (Bassilious et al. 2012) or even the acquisition of a second language (Rankin et al. 2008). There have been however claims of negative results from gaming, especially when their content promotes violence. For example, using a gun replica as a controller was found to increase the players' physical aggression (Kim et al. 2011). Moreover, studies conducted by Anderson and Bushman (2001) support the claim that violent video games increase aggressive behaviour, but can also decrease prosocial -voluntary behaviors made with the intention of benefiting others (Eisenberg, Fabes, Spinrad 1998)- behaviour.

Regarding the facilitation of social interaction between players however, the use of video games seems pleasantly promising. Xu et al. (2011) prove that despite the gap between the non-persistent game world and potentially persistent social relationships, a diversity of social relationships emerge and play a central role in the enjoyment of online games. Their study shows that even seemingly "unsocial" and virtually violent games can entail surprisingly rich and diverse social relationships. Additionally, they conclude that playing games is never isolated from real life, regardless of the genre of the game: "players reinforce their real life relationships both by strengthening weak ties and by sharing time with people who have strong ties through play". Osswald and Greitemeyer (2010), in a study intending to determine if playing a prosocial game would result in a person exhibiting prosocial behavior outside of the game environment, they showed that "activities from the video game translated into activities outside of the game environment. Prosocial activities within the game encouraged prosocial activities in the physical world".

A more particular case, for which the social effect of video games can be explored further, is between collocated people. A potential way to facilitate social interaction between players is by requiring from them to collaborate, in a way that face-to-face communication is necessary, in order to achieve a goal. A method to accomplish that is by using a shared '*play-space*'. The game Pac-Man Must Die (Sanneblad & Holmquist, 2004) accomplishes that by utilizing users' smartphone screens, where items that need to be collected are dispersed. The players need to look at each other's screen and –according to the authors- need to be close to each other and talk in order

to collaborate effectively. Another example is Table tilt (Powell et al., 2012) where players tilt their smartphones in order to navigate a ball into a hole. The hole can be on any of the players' screen, thus making communication and teamwork between them essential.

If collaboration between players is interpreted as a way of establishing significant communication between them, then approaches which enhance collaboration in video games are worth looking into. According to Klemmer et al. (2006), a way to accomplish that is by providing to the players visibility and mutual awareness of each other's actions. Additionally, in order to encourage interaction between players is to provide access to different sets of information and control of separate elements. A type of games that utilizes this method is that of massively multiplayer online role-playing games (MMORPGs)[1], where players have distinctive roles (e.g. tank, healer, damage dealer etc.), and need to cooperate efficiently to progress in the game.

2.5.   Summary

Video games have progressed rapidly over the last decades. The user interfaces utilized have evolved from the simple buttons and joysticks of early arcade machines, to the advanced touchscreens of current mobile devices. Handheld devices have a special part in the video gaming industry, with smartphones being the most important of the lot, mainly because of their popularity.

Although the vast majority of video games are designed for a single player, multiplayer games have always been engaging whether the players use the same gaming machine, or connected remotely. The popularity of multiplayer games has increased dramatically over the last few years due to the ubiquity of internet connectivity and the development of social media.

The most acknowledged reason for playing video games is enjoyment. Games however can also be used in order to achieve different goals, such as motivating students to learn, or meeting new people.

Video games have been proven to be an effective means to socialize, especially between people that communicate through the Internet, but also between collocated users. In the latter case, encouraging players to collaborate by using the same virtual space or by having distinct roles, can further facilitate social interaction between them.

Although playing video games with other people through the internet is extremely popular for most gamers, playing with others in the same area (co-located) is less so,

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[1] http://en.wikipedia.org/wiki/Massively_multiplayer_online_role-playing_game

and even though it has been utilized in gaming consoles with the support of multiple controllers, there is definitely room for further development in the world of smartphones. Hence, this thesis focuses on the development of mobile games for co-located mobile devices, aiming to examine the possibilities this approach has to offer and exploring the impact these games can have in face-to-face social interaction.

3. INTERACTION IN SOCIAL GROUPS

Even though the ubiquity of technology has made remote communication between people technically feasible and easily accessible, it is debatable whether people have become actually more social thanks to it. As the objective of this thesis is to explore ways in which technology can have a beneficial impact on peoples' social lives, particularly in contexts where groups of strangers meet in the same place, it is essential to study the characteristics of social relationships and groups, in order to identify the issues that can inhibit interaction, as well as come up with ways to overcome them.

This chapter begins with a brief description of the different kinds of social relations that can develop between people, and the types of groups that they can form. Then, some of the most common problems that can occur in social encounters which can prevent interaction between people are presented, followed by some popular methods to get around them. Finally, the ways that technology can enhance the effectiveness of these methods are explored.

3.1. Relations and Groups

According to the social sciences any relationship between two or more individuals is called a *social relation*. Any social relation can be the reason for *social interactions,* a term which has been the subject of many studies and theories by sociologists and anthropologists (Mucha, 2006). This section briefly examines the more intimate and personal relations that can be formed between humans, and what types of groups can be formed because of them.

3.1.1. Interpersonal Relationships

The *stronger*, *deeper* and more *personal* social relations are called interpersonal relationships, and can be formed as a result of different contexts such as cultural and social influence. There are many motivations that lead people to form these relationships; one of such motivations is the need of love and belonging, from Maslow's hierarchy of needs, which can affects a person's ability to form and maintain emotionally significant relationships (Maslow, 1943).

According to Dezfuli et al. (2011), interpersonal relationships, from the perspective of how they are interpreted by an individual, can be classified in the following categories:

1.   Stranger: people who don't know you at all.

2.   Friends; according to the authors there are six different subcategories of friends: Associate, useful contact, favor (people who only help each other in a functional manner), fun, comforter and confidant.

3.   Far family: family members who do not live together, and

4.   Close family: family members who live together

The duration of interpersonal relationships can be from brief to enduring, and while they last they tend to progress and evolve if people get to know each other more, or diminish if people move apart. According to Levinger's model (Kelley et al. 1983), there are five stages in the development of a relationship:

1.   *Acquaintance and acquaintanceship:* An acquaintance is often described just as "someone you know", and it describes a relationship less intimate than friendship. This first stage practically occurs when two people meet and start interacting.

2.   *Buildup*: This stage refers to any situation that can strengthen a relationship, which can happen with the gain of knowledge about the other's personality and the mutual gain of trust.

3.   *Continuation*: a relatively long and stable period where commitment is required, even if the relationship is between friends or between a married couple.

4.   *Deterioration*: the reasons behind this phase can vary and do not have to affect all sides of the relationship. This phase does not always occur, and sometimes it can lead to the next and last phase.

5.   *Termination*: the final stage that marks the end of the relationship.

The main focus of this thesis is on relationships that are formed between strangers, mostly in the first two stages, that of acquaintanceship and that of buildup. These relationships can be formed between more than two people simultaneously, which are usually referred to as social groups.

3.1.2. Social Groups

One of the fundamental aspects of a social group is the *social cohesion* between its members (Moody and White, 2007), which differentiates it from a random collection of individuals and refers to the various bonds that exist within the group, and hold it

together. Groups can be classified into *primary groups*, in which long lasting and intimate relationships occur, and which usually have a strong influence on an individual's personality (e.g. family), and *secondary groups*, which usually consist of more members, but are described by less intimate and less long-lasting interpersonal relationships (Andersen and Taylor, 2006).

Some of the most important characteristics of a group are:

1. Common goals: the members of a group share common objectives and one of the reasons that a group is formed is to make these goals more feasible.

2. Common interests: can be from a favorite sports team to a political ideology. There can be more than one common interests among the members of the same group.

3. Sense of unity: ("we" feeling) that feeling is usually developed gradually and it promotes loyalty and cooperation between members and helps them defend their interests collectively.

4. Norms: the set of rules or guidelines which the group members are supposed to follow. They can be official or unofficial, and through them the group exercises control over its members, up to a certain extent.

5. Similar behaviour: this is essential to allow group members to accomplish their common objectives.

According to Tuckman's model of group development, there are four inevitable phases during a group's lifetime: Forming, storming, norming and performing. Starting with the forming stage, group members are involved in initial assessments of the interpersonal relationships and norms within the group. Storming refers to conflicts that can occur between members before the group moves to the norming stage, during which interpersonal activities increase cohesiveness and define the members' behaviour. Finally, during the performing stage Group members work together to attempt problem solving and task completion

Some noteworthy types of groups include the following (Shibutani, 1955):

1. Peer group: people with similar interests or background and often age.

2. Community: a social group of a usually large number of members who share common values.

3. Team: the members of these groups are usually capable of accomplishing tasks of high complexity.

3.2.   Challenges and Facilitation

In a group of people who don't know each other well (strangers or acquaintances), the social interaction between its members can be inhibited due to several reasons. These reasons include the shyness of some members, and the lack of common ground between them, which can be used as a discussion topic or a cause to initiate conversation.

This section starts with an attempt to illustrate the most significant problems that restrain interaction between the members of a group, especially at its first encounter(s), and then presents some of the most popular and commonly used, traditional methods aiming to overcome those issues.

3.2.1. Impediments in Interaction

Although based on the characteristics described in section 3.1.2 a random crowd (or a flash mob) of people is technically a social group, it is apparent that interaction between people in such a situation is not a desired case. Hence, in this section are examined only groups with a potential to grow or evolve, for which the most common factors that stand as obstacles to the social interaction between members, usually during the initial get-togethers, are described.

Groups between unfamiliar people, where social interaction is required or expected, are formed very frequently in everyday life. This can happen incidentally, as a result of a social event such a party, where group members have met very recently. Members of such groups can be of different age, culture or have different social backgrounds; any notable set of common interests between them is coincidental. More often though these types of groups are formed intentionally, usually with the consent of all members, in order to achieve a certain goal (e.g. a dance class, employees before starting a group project etc.).

The following list includes the most common factors that prevent interaction from developing, between members of groups like the ones described above.:

1.   Shyness/Inhibition: Many people experience a sense of anxiety or even fear when they are about to interact with strangers, often accompanied by feeling worried that others may be critical of them or they might do something embarrassing (Plomin and Daniels, 1986). Usually, once this stage has been surpassed, people can cope with the situation and even enjoy themselves[1].

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[1] http://www.rcpsych.ac.uk/mentalhealthinfo/problems/anxietyphobias/shynessandsocialphobia.aspx

2.   Lack of common ground: Generally the topics of discussion among newly met strangers or acquaintances evolve around the current situation that they are in, or their common interests, values etc. if any. In order for a conversation to be initiated, it is essential that this common ground is uncovered (Clark and Brenan, 1991).

3.   Lack of motivation: As mentioned in 3.1.2, groups are formed (among other reasons) in order to make the members' common objectives more feasible. Interaction between two or more people is unlikely to occur until those objectives are discovered or introduced.

4.   Lack of initiative: The 'excuse' for someone to start interacting with someone else can be referred to as a *ticket-to-talk*. That 'ticket' can be any incidental occasion or activity that both parties realize, and which allows them to start interacting spontaneously (Svensson and Sokoler, 2008).

5.   Absence of trust: The lack of trust between people is a factor that can discourage interaction, and it usually needs to be built up (Barber, 1983).

The issues above can act as barriers between people in every phase of the social relations between them. Regarding the Levinger's model mentioned in 3.1.1, the lack of common ground, motivation and initiative can affect the acquaintance stage, while the shyness and lack of trust can also affect the buildup and continuation stage. This thesis focuses on the obstacles noticed within the first encounters of people who would describe each other as strangers, or familiar strangers (Paulos and Goodman, 2004). When interaction is required or expected in such cases, certain activities or methods are implemented to help in reducing the inhibiting factors.

3.2.2. Icebreakers

The set of factors that inhibit interaction within a group of people unfamiliar with each other, is often referred to as 'ice'. Activities and exercises which aim to break the 'ice', are commonly labeled as *icebreakers* or *ice-breaking* activities[1].

Icebreaking activities can be used in multiple occasions such as the first day of a class or in the beginning of meetings, and can aim either in achieving ideal dynamics within the group, or just entertaining the group's members. They usually last for a short time (no more than an hour) and involve an expert who is labeled as the *facilitator*, and who is responsible of organizing the activity and describing it to the participants (West, 1999), (Chulup and Collins, 2010).

The ice breaking activities can be classified[1] in the following categories:

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[1] http://icebreakerideas.com/what-is-icebreaker/

1. Active: Usually games, which require people to move around, including running, jumping and dancing. They combine social interaction with physical workout. An example of an active ice-breaking activity is *group juggling*, during which the group members stand in a circle and toss a ball to each other by calling the target's name. A player cannot receive the ball twice, and the activity is over when everyone has received and thrown the ball once.

2. Stationary: For this type of activities everyone sits in one place. They focus more on fun and humor. An example of a stationary icebreaker is the *Doctor game* in which one group member at a time acts as a patient, coming up with an imaginary disease but hiding its name. Another member is the doctor, who asks the patient questions about their symptoms and feelings, trying to guess the disease.

3. Get-to-know-you: Activities that help team members know each other better. They can focus on learning each other's names, or they can go more deeply, directing the attention members' interests, thoughts, personal goals and secret desires. A typical example is the activity called *Identity Circles*, where participants write their values (i.e. race, family, occupation etc.) on index cards (one value per card), and share with their partners why they chose to write each value. Then each participant has to destroy one card, reflecting how they prioritize their values. This activity iterates until each participant has only one card left.

4. Team-building: These activities are particularly useful in working environments, where members of a newly formed team are required to develop collaborating skills, in order to successfully accomplish their common goal. A noteworthy team-building activity is *Connecting Stories*, which starts with a participant sharing a short personal story or memory with the group. The next participant has to share a story of his/her own, connecting it somehow to the previous member's story. An interesting feature of this activity is that a large group can be divided in smaller groups, which can compete against each other over which will be the group that creates the longest chain of stories, thus introducing the competition aspect to enhance the motivation for effective teamwork.

Other icebreakers include games that are often played in parties, like *truth or dare*, or *Never have I ever*, where players are required to share more intimate and detailed personal experiences.

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[1] http://www.icebreakers.ws/

Ice-breaking activities can be facilitated with the help of technology. Relevant cases are covered in the next session (3.3) which examines how technology can be used to facilitate group social interaction in general.

3.3.   Utilizing Information Technology to Facilitate Social Interaction

The progress of Information Technology and especially computer networking has led to the international phenomenon of social media, with the help of which people can instantly communicate with their peers anywhere no matter their location, and share personal information online, making it accessible to the world.

Workplaces and organizations have benefited from technology by utilizing computers to support cooperative work in group projects[1]. Online communities and distributed workplaces can be useful tools for professionals. The lack of face-to-face interaction however, can negatively affect performance at work, as it has been found to prevent the development of interpersonal relationships between members of the same social group (Dixon and Crooks, 2006).

The approach of Single Display Groupware (SDGs) utilizes large displays in order to increase the awareness that each team member has of the other members' activities, which has been found to increase teamwork (Dourish and Bellotti, 1992). Additionally it provides access to the task for all the members of the collaborative group, giving everyone the chance to contribute equally (Stewart et al. 2009). Kreitmayer et al. created a digital simulation of a system called UniPad designed to be used in classrooms (2013), which uses shared tablets and a wall display. Unipad was found to have a positive effect on the teamwork and cooperation in making decisions between the students. It was also observed that it enhanced the classroom's cohesion and increased the students' average level participation.

Having the successful utilization of tablets in the case of UniPad as an example, it could be assumed that the ubiquity of the mobile devices nowadays can be used to promote interaction between people outside the collaborative work context as well, especially with regard to reserved and introverted people. According to Jarusriboonchai et al. (2014), mobile technology can be used as a moderator to facilitate face-to-face interaction.

Ice breaking activities can also evolve into being more effective and engaging with the integration of technology, particularly when it comes to providing resources for interaction between people. Yoon et al. (2004) created a multiplayer game for visitors at a café, called FishPong. In FishPong players were able to control their character

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[1] http://cscw.acm.org/2015/index.php

using their mugs as controllers. The researchers found that the visitors of the café started interacting with other visitors sitting close to them, because of the game.

3.4.   Summary

Interpersonal relationships are the stronger and deeper social interactions that can be formed between two or more individuals, and can be classified to strangers, friends and family. If these relationships exist between more than two people, social groups can be formed, which are groups of people that share common interests, objectives and can develop a similar behavior and follow a set of norms.

Among a group of strangers, there are factors that can inhibit social interaction. These factors can be people's shyness or withdrawal, the lack of discussion topics and trust, the lack of initiative to initiate a conversation (ticket-to-talk) and the absence of motivation.

In order to tackle these issues a set of methods and activities have been developed, called icebreakers (or ice-breaking activities). These can be active or stationary, and can focus on getting people to know each other or to form a sense of unity and trust among the members of a group.

Technology can have a positive impact on interaction between people in a group, for example by using a shared screen in a group of collaborating workers. It can be also be used to facilitate ice-breaking activities, also utilizing mobile devices.

Since the aim of the thesis is to create an ice-breaking activity, it was essential to understand the obstacles that impede interaction between strangers during the first stages of the forming of the relations. It was also important to comprehend what are the deficiencies of current traditional ice-breaking activities, and how these can be improved with the use of technology. In order to accomplish that, studying the ways that information technology has been used for similar objectives was necessary.

4.   DESIGN AND IMPLEMENTATION

The development of the "*Who's next?*" mobile application was an iterative process that lasted several months and consisted of two main phases. The first phase was that of ideation and design, which included the conformation of the main concept of the application, the general content as well as the detailed rules and features of the game, and finally the designation of the fundamental goals and objectives of the whole project. The second phase was that of implementation, and it consisted of several stages: conducting thorough research and studying of literature and documentation related to software development for the Android platform, building the required programming code in order to materialize the application, creating a basic but appealing and efficient user interface, and apply many iterations of testing the application and fixing issues and errors as well as modifying the game's content, in order to improve the software's functionality and the gaming experience.

This chapter describes the whole process of the project's implementation phase, starting with the   development of the idea and the design of the game. Then, a comprehensive description of the application and its different features is given, as well as the rules and objectives of the game. Next, some technical details about the software development and the technology used are briefly presented, and finally any unsolved issues and limitations are outlined, along with some thoughts and suggestions for potential future additions and improvements.

4.1.   Iterative Forming of the Application Concept

In order to conceive the main idea of the game, several brainstorming sessions were conducted. The primary objective was to build a project that would be consistent with the research interests and goals of the people involved in its development, with the appropriate amount of conceptual novelty and technological innovation needed to get interesting and useful results through a user-centered evaluation process. The ultimate goal was to create a playful mobile application, which would facilitate social interaction between people in the same location.

The concept was formed in collaboration with the thesis supervisors through an iterating process, during which different ideas were illustrated using paper prototyping and storyboards[1], utilizing the UCD methodology. Meetings were conducted to discuss these ideas, and assess if they were capable of developing into an application that would encourage face-to-face interaction between strangers, and

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[1] http://accad.osu.edu/womenandtech/Storyboard%20Resource/

motivate them to exchange their personal information in a playful way. The extent to which those different concepts could be evaluated as effective in breaking the 'ice' and facilitate social interaction was also considered.

The term "co-located" is used to refer to people or mobile devices in the same location. For the purposes of the current project, that was limited to a distance where the users of the application would be close enough to have visual contact with each other, as well as to be able to listen to each other's voice clearly, even in a public place with noises from the surrounding environment. The target context of use and user groups of the applications were defined early in the process, providing a clear direction to the ideation procedure.

As mentioned above, one of the aims of the application was to facilitate social interaction. In the beginning of the ideation phase, that was interpreted as either initiating social interaction between strangers, or enhancing interaction between people who are already familiar with each other but not comfortable or motivated enough to converse.

As described earlier, the initial stage of the project where the application's concept was formed, consisted of several brainstorming sessions with a specific intent: to create an idea for a mobile game, which would facilitate social interaction between co-located people. Until the development of the final idea, several approaches were examined and assessed. The two most notable ones are presented below.

Figure 4.1 *Part of the storyboard used to describe the "Let's sync!" game.*
Players had to synchronize while performing gestures simultaneously,
in order to beat the game.

The first idea that was formed was a mobile game called *"Let's sync!"* (Figure 4.1). The game was intended for two players within limited range from each other, who would pair-up their smartphones and either collaborate or compete against each other in performing touch gestures on the device's screen. In the collaborating mode, both players would see the representation of series of gestures on their screen and then

would be asked to repeat these gestures, trying to synchronize their hand movements. The players' performance and advancement in the game would depend on how well they could coordinate their actions, so a considerable amount of communication would be required between them while playing. In the competitive mode, players would take turns in coming up with a gesture and perform it on their devices. That gesture would be recorded and reproduced in the other player's screen. Then, that player would have to memorize the gesture and repeat it within a short amount of time.

A session of that game between strangers could be easily assisted with a simple feature of discovering nearby players. However, it wouldn't provide a strong motivation for a user to overcome any initial inhibitions in order to ask a stranger to play with them. While interaction -visual and verbal- between the players during the game is essential, it provides little guarantee that the users would be stimulated or even interested in communicating outside the boundaries of the game. Another disadvantage of such an application would be the great difficulty in evaluating the effectiveness of its social aspect.
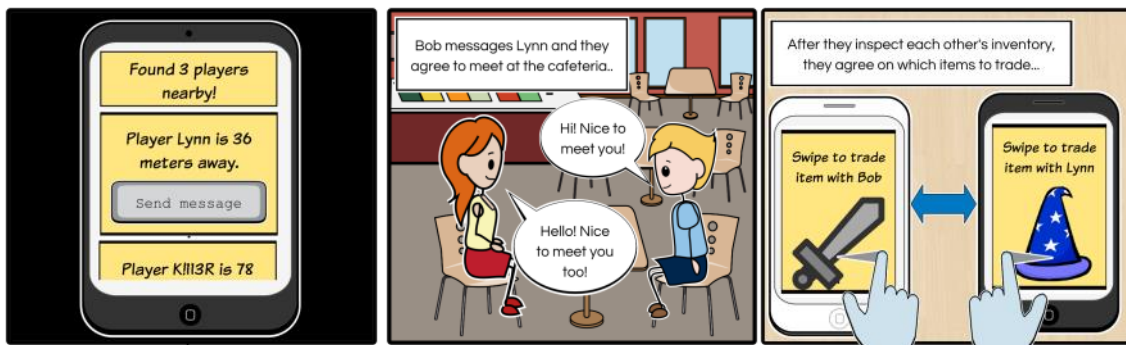

Figure 4.2   *A part of the storyboard for the "Social Quest" game, depicting the process for discovering and meeting other players in order to trade items.*

The second of the initial ideas was *"Social Quest"* (Figure 4.2). It would involve the development of a 2D role-playing game, which would require co-located interaction between players. In particular, the users would be able to advance their in-game character by trading rare items (gear) with other users by placing their smartphones next to each other. A player would be able to search for other active players located nearby, message them and arrange to meet. Then and after placing their phones in within small proximity, they would be able to inspect each other's inventory of items, and choose to trade. Finally, the users would have the option of adding each other as friends in the game, and get notified whenever they are nearby, but also be able to send exchange instant messages to arrange meetings for further item trades.

Given that the game would be interesting and engaging enough, in-game advancement could prove an adequate motivation for players to meet and interact with each other, potentially even more than once. Also, the fact that a player would have to be in the same physical space with other players in order to eventually make progress in the game could turn out to be a rather frustrating obstacle for some players. The main reason for not proceeding with the development of that concept was the great effort and time that would be necessary to implement the game, and was thus considered out of the scope of the project.

4.2. Final Game Design

The idea that evolved into a fully developed mobile application, which was also tested and evaluated later on, was that of the "Who's next?" game. *Who's next?* is a game for a small (4-10) group of co-located players, using smartphones with the Wi-Fi Direct technology, aimed to facilitate social interaction between them. The more specific objectives of the game are flexible and depend mostly on the context of use.

Who's next can be played in a group of strangers who meet for the first time and need to introduce themselves, aiming to serve the purpose of an "ice-breaking" activity, that would be more engaging and less cumbersome to participants, than the traditional icebreakers described in chapter 3. Additionally it can be played in a group of people who have already met but barely know each other, often referred to as acquaintances or familiar strangers. In that case the game's objective -apart from breaking the ice- is to offer an effortless way for players to share their interests, preferences and other personal information with the whole group. Finally, *Who's next* can also be used as an enjoyable past time between friends, with the supplementary objective to deepen the knowledge of each other's character.

During the game the players need to answer a set of pre-defined questions, and are afterwards required to discover which of the other players gave a specific answer to each of those questions. A full session of the game consists of three phase: the initial set-up, the question-answering phase and the playing phase. Each of those phases is described in detail in the following paragraphs.

4.2.1. Initial Set-up

The game uses the Wi-Fi Direct technology to establish a connection between the players' smartphones (technical details about this technology are given in the next section). When a user starts the application and view the home screen, they can choose to create their own game, or join another user's existing game. A user in the group needs to create a game (will be referred to as "*main user*"), and the others need

to join. Once the main user selects the 'Create Game' option, he or she is asked to set some parameters (game settings) that will customize the game:

- The *familiarity level* defines the set of questions that the players will have to answer when the actual game begins. The user selects from a drop-down list one of the three possible options: Strangers, Acquaintances and Friends.

- The *timer duration* defines the duration of each round of the game, in a range from 1 to 5 minutes.

- The *group's name* is stored in order to be displayed in the 'High Scores' table, along with the group's total score.

After these parameters have been set, the user taps on the 'Submit' button and is directed to the next screen, where they can see the list of the devices within Wi-Fi range that are running the application and have selected the 'Join Game' option from the home screen. From the list of the devices the user who created the game can tap on any device to send an invitation. The user of the corresponding receives a confirmation dialog, and when he/she confirms, the connection is established. The list shows each device's WFD name, as well as its WFD status, which can be *Available*, *Invited* or Connected. When all the devices are connected, the main user can tap the '*Start Game*' button, which will direct all the connected players to the question-answering phase (Figure 4.3).
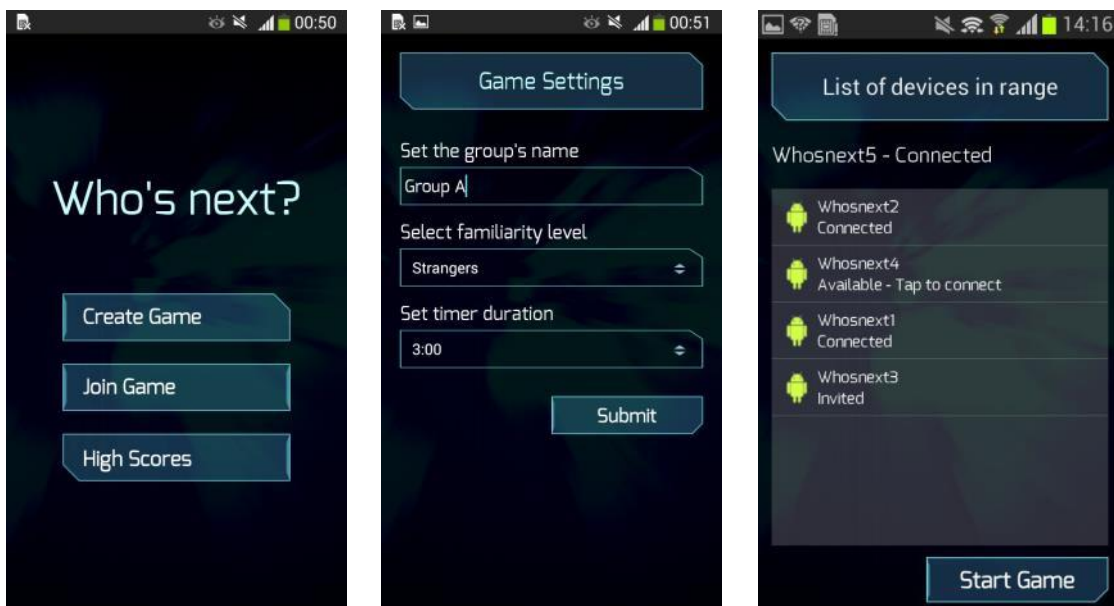

Figure 4.3   *From left to right: the home screen, the game settings screen and the list of devices screen.*

4.2.2. Answering the Questions

In the second phase of the game the players, after typing their name, are required to give answers to the set of questions that corresponds to the familiarity level selected in the game set-up. The content of the game was tailored to the needs of the project and with the intention to evaluate it by conducting user-study sessions in the university campus area. Thus, the questions used in the game are addressed to young people (mostly university students or university staff) mainly within the range of 20 to 35 years of age.

Table 4.1 *The set of questions included in each familiarity level*

| Familiarity level	Question Text
Strangers	Where are you from?
	When is your birthday?
	What do you study?
	What is the street name of your address?
	What was the name of your previous school?
	Name your favourite movie/TV show.
	Name your favorite musician/band.
	What is your favorite hobby?
Acquaintances	Name your favourite movie/TV show.
	Name your favorite musician/band.
	What is your favorite hobby?
	Your favorite drink?
	Name the sport you like to watch most.
	What is your zodiac sign?
	Where was the last place you traveled to?
	What is your worst fear?
Friends	What is your favorite food?
	Where was the last place you traveled to?
	Your favorite celebrity?
	A chore that you hate doing?
	A place that you want to visit most?
	If you win the lottery, what is the first thing you will do?
	Where is your favorite travel destination?
	What is your worst fear?
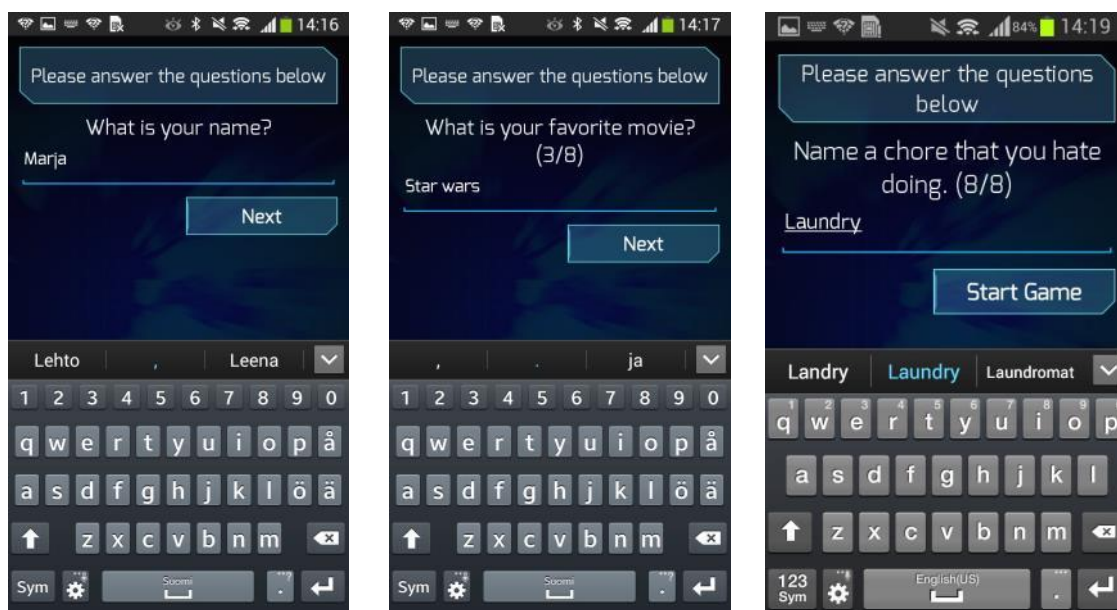
Figure 4.4 *The question-answering phase, before the actual gameplay starts. The 'Next' button is replaced by the 'Start Game' button on the last question.*

The criteria of choosing the specific questions shown in Table 4.1 were to provide an opportunity for players to share basic information about themselves, which would help others create a general idea about their background and personality. It was also important that having to answer those questions would not make the players feel embarrassed or uncomfortable.

Each device shows one question at a time, followed by a blank text field which the players need to fill by providing their answer. There are no restrictions to what the answer can be, other than that it cannot be left blank. Thus, the players can technically choose not to directly answer a certain question, if doing so makes them feel uncomfortable. When the players reach the last question, the 'Next' button is replaced by the 'Start Game' button (Figure 4.4), and when all the players have pressed the 'Start Game' button, the game begins.

4.2.3. Playing the Game

When all the questions have been answered on every device participating in the game and the 'Start Game' button has been pressed, a countdown timer is initiated for the duration defined during the game set-up, and a relevant *toast* message is shown on every device, indicating the beginning of the game.

When the game is initiated, the 'questions-answers' list is created, which contains all the answers the players gave paired with the corresponding questions. For every element of the list (question-answer pair), the name of the player who gave the answer

is also stored. The order of the elements in the list is randomized and in the beginning all elements are marked as 'not used'.

During the game, one device at a time is the active device (its user will be referred to as the '*active player*'). The players take turns in being the active player in a pseudo-random order, based on the order that the initial networking connection between the devices was established. While the same order was repeated in every round, participants would get to be active players in a non-sequential manner, making the game more unpredictable and keeping them alert waiting for their turn. The active player's device shows one question-answer pair from the list mentioned above, followed by a list containing the names of all the players in the game apart from the active player's. Also, the question-answer pair shown cannot "belong" to the active player (the active player cannot be the one who gave that particular answer).
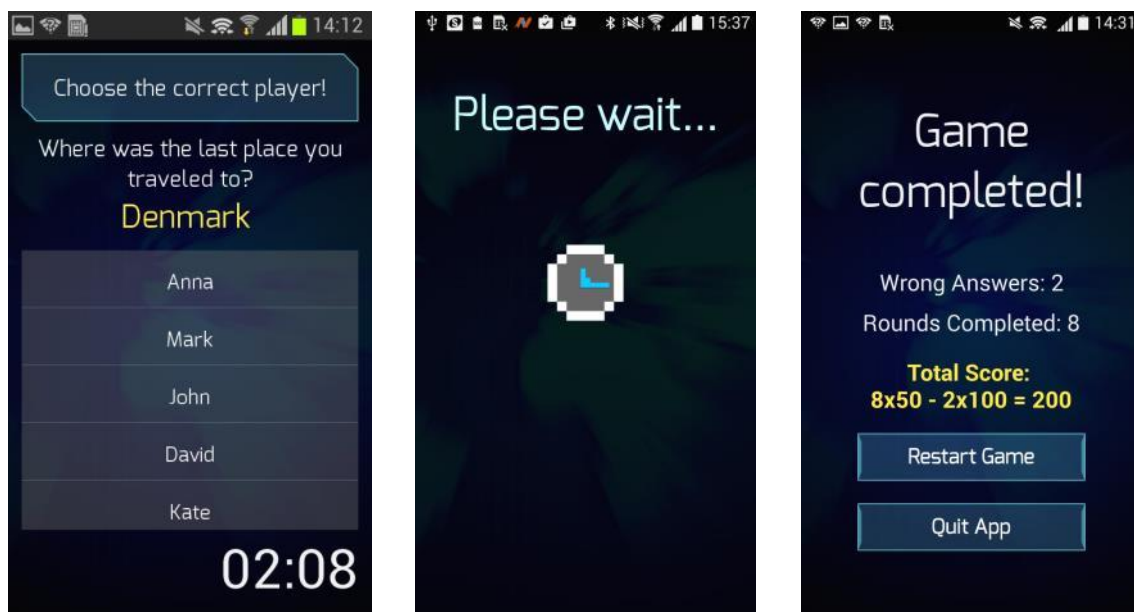
Figure 4.5   *The main phase of the game. Players wait for their turn to become the active players and find the name that matches a random question-answer pair.*

The task for the active player is to find the matching name for every question-answer pair (i.e. the player who gave the particular answer) and select it. That question-answer pair is marked as 'used' on the list, and will not be used again in the current instance of the game. When the wrong name is chosen, the player is prompted to try again, until they get it right. When he/she selects the correct one, the next player becomes the active one, and is shown another randomly selected *not used* question-answer pair from the list. In addition to the question-answer pair and the list of player names, the active player can also see the countdown timer at the bottom of their screen which is updated every second. The players are rewarded with 50 points every time they answer correctly and receive a penalty of -100 points every time they tap on

an incorrect name. The players who are waiting for their turn, see the '*Please wait…*' screen (Figure 4.5).

The game comes to an end when the countdown timer reaches zero, or when all the question-answer pairs from the list have been used in the game, and all players see the end-game screen. In the first case the screen shows a '*Game Completed!*' message, while in the second case '*Time Up!*'. The screen also shows information about the personal performance of each player: their total-score, the number of completed rounds and the number of wrong answers. Finally, it contains a button for quitting the application, and another one for restarting the game, which is only shown on the *main* device. When the '*Restart Game*' option is selected, the countdown timer is reset to the initially selected duration, all the question-answer pairs in the list are marked as *not used*, and the game starts again. The list of question-answer pairs used in the new round is the same, but the order is randomized anew.

- A set of sound samples are used to provide audio feedback for the players' different actions, and the various states or phases of the game:

- A bell sound to notify the active player that it is their turn to play.

- A '*buzzer*' sound, when the active player taps on a wrong name from the list of players.

- A cheerful melody played in every device when the game is completed within the time limit.

- An '*unhappy* melody when the time runs out and the game is over.

- A '*ding*' sound in the pass of every minute since the beginning of the game.

- A '*clock-ticking*' sound during the last ten seconds of the game.

In all of the above cases the mobile device's vibration function is used accordingly, in order to enhance the provided audio feedback.

4.3. Implementation

As mentioned above, *Who's Next* was implemented as an application for mobile devices running the Android operating system. The Android platform was selected because of its popularity, the accessibility and convenience of the plethora of developing tools and documentation available, and the wide range of mobile devices that use it as their main operating system.

The following sections give an overview of the different implementation choices that were made, as well as the general architecture of the programming code and some technical details on how the application is structured. Finally, the technical limitations of the developed system are presented, along with some thoughts and ideas for possible future improvements or further expansion.

4.3.1. Wi-Fi Direct and Networking

The primary way of connecting the devices used in this project with each other is WiFi Direct (or Wi-Fi P2P). There are several advantages this technology has to offer, but also some difficulties, the most significant (and relevant to the project) of which are mentioned below. Moreover, a concise explanation is given of how the API of this framework has been used.

A BroadcastReceiver object is used to listen for broadcast intents from the operating system about changes in the Wi-Fi P2P state of the device, for example when Wi-Fi Direct is enabled, when a device has been added or removed from the list of devices in range, or when the connection status of the device is modified.

Once the server device has formed the list of devices in range, the user can tap on any device on the list, in order to establish a connection –as mentioned earlier. If that device's status is 'Available', an invitation to set up a Wi-Fi Direct connection between the two phones is sent. A confirmation dialog is shown on the target device, in which selecting 'OK' permits the completion of the connection. This part cannot be avoided due to the Wi-Fi Protected Access protocol (WPA)[1] that regulates the Wi-Fi Direct framework. The server device is set to be the group owner in every connection, by setting the maximum value (15) for the *groupOwnerIntent* argument of the *WifiP2pConfig* object. When all the desired Wi-Fi Direct connections have been established, the client devices use the acquired server's IP address to open a socket connection with the server in order to be able to send and receive data during the game.

While the game lasts, the server device is using one thread for each connection, running in the background and waiting from messages from the clients. Once a message from a client has been received, the corresponding action is taken by the server. When the server is required to send a message to one of the clients, a new thread is created which uses the existing socket connection to make the transmission. The client devices on the other hand also keep a running thread which is waiting for messages from the server, and create a new temporary thread for every outgoing message. The term '*message*' here refers to any package of useful data that is

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[1] http://www.wi-fi.org/discover-wi-fi/security

transmitted between the devices within the duration of the game, and is explained in the next section.

The networking approach taken for the implementation of the *Who's Next* game has several advantages, when compared to other alternative networking approaches, such as using the Bluetooth framework or an Internet based solution with the help of a web server. The most important of these assets of a Wi-Fi Direct based solution are stated here (Asadi and Mancuso, 2013):

1. Connection independency: As with Bluetooth, a connection based on Wi-Fi Direct does not require internet connectivity or connection to an access point. This is an important feature that makes the game playable anywhere, as long as the players are within each other's range.

2. Speed: Wi-Fi Direct supports typical Wi-Fi speeds, which can be as high as 250 Mbps[1] (about 10 times faster than Bluetooth), which is essential in order to ensure a satisfying experience for the users while playing the game (real-time exchange of data between the devices and synchronicity). Although high speed is not a necessity in the game, having delays in data transfer between the devices would slow down the game process, which could result in reducing the players' engagement.

3. Efficiency: Android's Wi-Fi P2P API provides a feasible and efficient way to implement *one-to-many* networking topologies, enabling the utilization of the *client-server* architecture that was considered as necessary for the *Who's Next* game. Moreover, it is applicable to a very wide range of devices.

4. Range: According to the Wi-Fi P2P technical specifications[2] the maximum range is 200 meters (600 feet), while for Bluetooth[3] it is reported to be no more than 60 meters. Although the physical range that the Bluetooth technology offers is enough for the needs of the current project, this considerable difference signifies a technological superiority, making Wi-Fi Direct a more promising choice to build on.

However, using the Wi-Fi Direct framework does not come without restrictions; while there is technically no limit to the number of simultaneous connections, the testing that succeeded the implementation of the game showed that connecting more than 8 devices made the phones somewhat unresponsive and slower than usual. Also, the fact that all the connections have to be established separately -due to security reasons- makes the set up phase of the game last longer. Finally, the devices' power

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[1] http://www.wi-fi.org/knowledge-center/faq/how-fast-is-wi-fi-direct
[2] https://www.wi-fi.org/wi-fi-peer-to-peer-p2p-technical-specification-v1
[3] http://en.wikipedia.org/wiki/Bluetooth

consumption while connected via Wi-Fi Direct seemed to increase significantly. The game was designed to be played in relatively small groups of 4 to 6 people, and last for a few minutes. Thus, the aforementioned technical restrictions were not considered as real issues for the purpose of the user studies.

4.3.2. Software Architecture

The central and primary component of the *Who's Next* application is the *MainActivity*, which extends the Activity class and is initiated when the game is launched by the user. The MainActivity controls the most essential elements of the application and is responsible for coordinating the required actions for every part of the game. In particular, the MainActivity is in charge of storing and retrieving records to and from the database, manipulating the UI elements (fragments), regulating the establishment and maintaining of the network connection between the devices and deciding which actions each device performs depending on the game's state.
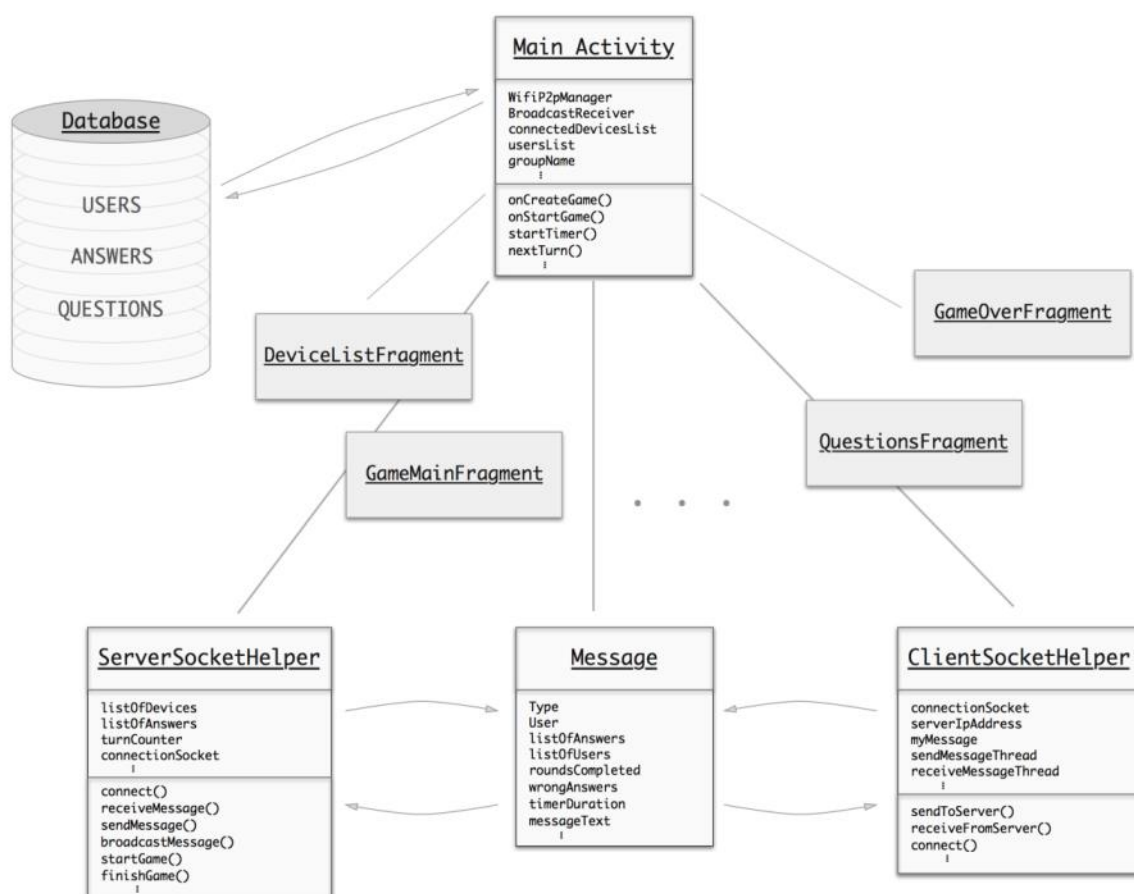

Figure 4.6 *This diagram shows the relations between the different parts of the software. The main activity is responsible for creating all the UI elements (fragments) and coordinating the required actions for each phase of the game.*

The database is created by the application on each device, using the SQLite database management framework offered by the Android API. That database holds the tables for storing the list of Questions, Answers and Users in every game, and all the necessary functions for performing the required operations, such as adding new elements, deleting existing ones or searching and selecting elements using specific criteria. The tables however are populated and used only on the device that acts as the server (group owner of the Wi-Fi Direct network connections), and only after the game has been created and set up. The questions that are stored in the corresponding table are read from a hard-coded text file, selected according to the familiarity level set by the server's user. The players' names are transmitted from each device to the server when the players type them in the beginning of the questions-answering phase (see section 4.2.2), and are stored in the Users table. After the players have answered the questions, the answers are also transmitted to the server and stored in the Answers table. Each answer record, apart from the answer's text, also contains the id of the matching question, as well as the id of the player that typed it. This information is used to determine whether the active player in the game selects the correct name from the list of players corresponding to a given question-answer pair.

Although the server and client devices run the same version of the application, consisting of the same programming code, there are two parts in the software that are used in only one case: the ServerSocketHelper and the ClientSocketHelper.

As the name implies, the ServerSocketHelper is in charge handling all the required networking operations from the server's part. It creates and maintains the background-running threads for receiving messages from each client device, and creates a new thread for each outgoing message, using the appropriate connection socket. It is also responsible for coordinating the flow of the game, e.g. by broadcasting a message from every device that the game has started, or that the countdown timer has reached the zero value. When notified from the MainActivity that a new turn is about to start, the ServerSocketHelper uses a randomization function to get the next random element from the question-answer list that hasn't been used yet in the game, selects the next active device, and sends the question-answer pair to that device along with the appropriate message to notify it that is its turn to play.

The ClientSocketHelper on the other hand is the part of the code that runs only on the client devices. It is in charge of creating and maintaining the thread responsible for receiving messages from the server, as well as creating a new thread in order to send back the appropriate response. When a message from the server has been received, the predefined action is taken depending on the message's content. For example when the message informing that the game is over has been received, the ClientSocketHelper is responsible for initiating the required actions to display the game-over screen, to

calculate the player's individual score and send the number completed rounds and mistakes made back to the server.

In order to effectively communicate with each other during the different phases of the game, the devices exchange information with the help of the Message class. A message object mainly consists of two parts: its type (which acts as an equivalent to a header), and the useful information it carries. The type determines the purpose of the message, which can be anything that signifies a specific part of the game or a particular action the server or the clients need to perform (e.g. game started, game over, next turn etc.). When a new message is received either by the server or one of the client devices its type is identified. According to that, the related data is read the information is used to perform the appropriate actions. For example, when a message of the type "*PLAY*" has been received from a client, the Answer object inside the message is read, which contains the question-answer pair the server has chosen for the current turn. The client then uses that to display the main game screen with that question and answer, followed by the list of players which has been received from an earlier message.

Finally, the fragments are the elements of the program that are responsible for the different parts of the user interface. There is one fragment for each of the main screens of the game. The MainActivity is in charge of loading the right fragment for each stage of the game. The fragments contain all the buttons, images and text fields that are used to convey information to the users, or as a means of users to input data (Figure 4.6).

5.   USER STUDY

A group-based user study was chosen as the most appropriate way to practically assess and evaluate the usefulness and efficiency of using *Who's Next*, as well as the social impact of the game in real-life conditions. A total of 6 study sessions were conducted, with groups of 4 or 5 participants, who were asked to play the game and were then interviewed to express their opinion about the game's concept and describe their experience from playing. In order to acquire useful feedback from the participants, the audio and video of the whole duration of each study session was recorded. These were later used in two ways: to observe the participants' behavior during the course of the game, and to transcribe the text of the discussion (interview) that succeeded the game in order to create an affinity diagram, which helped produce valuable conclusions (described in the next chapter).

In this chapter the main objectives and expectations of the user study are described first. The process of recruiting the participants and the criteria of forming the groups are covered next, followed by some basic information about the participants that formed each group. Then, the procedure of a typical user study session is illustrated.

5.1.   Study Objectives

The user study sessions were envisioned as an attempt to determine the effectiveness of the *Who's Next* game in serving its purpose -as an ice-breaking and group building activity, in its designated context of use: the first encounter between a small group of people, who would describe the other group members as strangers or familiar strangers. This broad goal is broken down into more detailed and specific objectives below. The following research questions depict the expected results related to the observed actions of the participants:

1.   How did the participants behave while playing the game, what kinds of social interactions were developed between them and to what extent?

2.   What were their reactions and approach to the game's different rules and requirements?

3.   In what ways and to what extent did the game affect the social interaction between the players, both during the game and afterwards.

4.   how did smartphones affect players' user experience while playing the game, and the interaction between them.

Regarding the discussion that followed the game, the questions addressed to the participants aimed to give answers to the following issues:

1. What were the participants' main impressions and opinions of the game's concept?

2. How is the game compared to other traditional ice-breaking activities that the participants have experienced?

3. What were the participants' thoughts on some particular elements and aspects of the game?

Moreover, during the discussion, participants were encouraged to express their ideas and recommendations about potential modifications or additional features that could be implemented in order to make the game more appealing or successful. Finally, they were encouraged to suggest different contexts in which an ice-breaking activity based on the same concept could be applied. The full list of the questions that were discussed the participants after they played the game can be found in appendix A.2.

5.2. Recruitment Procedure and Participants

The process of recruiting participants for the user study was addressed to university students or university staff. Besides being more convenient and feasible to recruit people from that certain community, it was also a way to ensure that the user groups for the study sessions would be more homogenous, in terms of age, and familiarity with technology and mobile games. On the other hand, the university community consists of people of different nationalities and backgrounds. That could help create varied groups, providing potential for interesting social interactions between the participants.

The study was advertised (Appendix B) at the university's online portal for students and personnel, where a call was posted asking people to join the user study. It mentioned that *there would be a game demo which they will be asked to play, followed by discussion and feedback about the game*. Additionally, the study was also publicized in some classrooms and to few of the researchers' associates, who had however no knowledge of the project and its purpose. It was important that none of the participants were informed in advance about the research goals of the study, in order to remain unbiased, and provide their honest and objective feedback. The reward offered was a free movie ticket for every participant as an appreciation token. The means of applying was to fill in and submit an online form. In that form, volunteers were required to fill in their names and contact information, along with some basic personal background information, which was used in order to choose the

people that would be most appropriate to participate in the study, and divide them into balanced and diverse groups.

After one week's time, a total of 61 volunteers applied out of whom only 12 were female. Within the list of all the applicants there was the surprising number of twenty different nationalities. Due to the game's design, but also because of technical and resource limitations, the ideal number of people that would participate in each session was decided to be 4 to 5. A total of six sessions were conducted, a number that was determined to be suitable for the size of the project, but also adequate to provide sufficient research results.

The original aim was to create groups as multicultural as possible, and include people of both genders in each session. Moreover, it was sought to minimize the chance of having participants that know each other in the same group (applicants were asked to state the name of any of their friends who could apply as well). Because of difficulties in arranging the sessions and coordinating the participants, the previously mentioned criteria were not always met. Since all the applicants were either university students (undergraduate and post-graduate) or university staff (researchers etc.) and their associates, they were assumed to be within the same age group; hence, age was not taken into consideration while forming the groups. Detailed information for the participants that formed each group is shown in table 5.1.

Table 5.1 The main characteristics of the six groups of participants
in each session of the user study

Session	Age range	Nationalities	Male/Female
1	23-36	Russian, Spanish, Nepali, Finnish	1/3
2	22-28	Finnish, Indian, Mexican	2/3
3	24-34	Indonesian, Chinese, Latvian, Mexican, Isreali	3/2
4	26-35	Thai, Pakistani, Syrian, Irannian	4/1
5	23-29	Indian, Romanian, Thai	3/2
6	24-27	Bangladesh, Pakistani, Iranian	3/1

The total number of participants who took part in the study was 28 (16 male and 12 female), representing 16 different nationalities. Although it was intended for all the participants to be strangers towards each other, it was not possible to predict the relationship between all of the applicants in the recruiting process. Hence, there were a few cases of participants who knew each other up to a certain extent (but would not however describe each other as close friends). The majority of them were either complete strangers or 'familiar strangers', meaning people who recognize each other from having participated in common activities, but who do not interact (Milgram, 1977). Nevertheless, the fact that this kind of varied familiarity between the participants existed in each group, was interpreted as a feature that would make the sessions resemble the real-life conditions in which an ice-breaking activity like *Who's Next* would be used.

5.3. Methods and Procedure

As reported above, the user study consisted of 6 sessions with groups of 4 or 5 participants. Each session was held in a quiet and cozy room inside the University campus (Figure 5.1). The participants sat comfortably in a semi-circle around a table, where snacks and beverages were placed. The physical environment was set up in a way that would create a peaceful and laid-back atmosphere, which would help the participants feel relaxed and forget as much as possible that they were part of a study. These circumstances would resemble the real-life contexts where ice-breaking activities would be used, but also encourage the participants to behave more freely and spontaneously. Moreover, the participants were ensured that their feedback would be reported anonymously, and that there was no specific behavior expected from them, other than to act naturally. Regarding the interview, they were urged to speak their minds and express their opinions sincerely, and it was made clear to them that even negative viewpoints and disapproving feedback about the project's concept would be equally useful and welcome. Each session lasted for about one hour, of which playing the game took 20-30 minutes.

5.3.1. Background Questionnaire

In the beginning of each session, a questionnaire was handed to each of the participants, which they were asked to fill in. Apart from giving their personal information (age, nationality, gender etc.), participants needed to provide answers to some background questions regarding the familiarity with activities relevant to the *Who's Next* game, as well as their viewpoint on their own sociability and their relationship with modern technology. The inclusion of this questionnaire in the user study had two purposes:

1. To gather collective data about the different groups but also from all the participants as a whole, in order to form a general image of the people who took party in the study. That could be correlated with the findings of the study and help in the formation of generalized conclusions later on (see chapter 6).

2. To retrieve information about each participant separately, in order to make some assumptions about their individuality, and be able to interpret their feedback and behavior more efficiently.

The questions related to personal information in the background questionnaire were free-text forms. The questions the answers of which were objective could be answered with a multiple choice answer.

The questions in the background questionnaire were divided in three set. The first set consisted of the personal information questions, which required a free text answer. The second set required the participants to indicate how often they had performed certain tasks over the last month. The answer could be given by selecting one of the options available: '*I don't know what it is*', '*Never*', '*Once*', '*Sometimes*' and '*Frequently*'. The multiple choice model was selected for the participants' convenience, and the period (month) was believed to be enough to describe the respondent's general habits. For the last set of questions participants had to declare their level of agreement on certain statements, by choosing a certain value from a Likert scale (Bertram 2007), ranging from 1 to 7, with 1 indicating strong disagreement, and 7 complete agreement. The Likert scale was considered appropriate for the specific questions, since it would provide quantitative data without forcing the respondents to express an explicit opinion.

Some of the most noteworthy aggregated data about the user study participants that were gathered via the background questionnaire are shown in Table 5.2. Almost all participants were everyday users of a smartphone device and very accustomed to the idea of sharing personal information with others with the help of technology. Additionally, the great majority of participants were positive against using technology for social purposes and its effects on social life. However, although most of the participants stated that they often have to meet new people in their daily lives, there were a significant number of them who did not claim that they had no problem making new friends.

An exact copy of the background questionnaire that was used in the user study can be found in appendix A.1.

Table 5.2 The accumulated responses for some of the questions of the questionnaire, to create a general picture of the participants.

Question	I don't know what that is	Never	Once	Sometimes	Frequently
In the last month, how often did you:					
Use a smartphone	0	0	0	1	27
Use a social platform/website	0	0	0	2	26
Play a mobile game	0	3	3	14	8
Play a multiplayer game	0	7	4	13	4

Question	1 (strongly disagree)	2	3	4 (neutral)	5	6	7 (totally agree)	Mean	St. deviation
I consider myself a social person	0	0	2	4	7	8	7	5.6	1.15
I enjoy meeting new people	0	0	0	3	8	10	7	5.86	0.90
I have no problem when it comes to making new friends	0	0	4	3	7	11	3	5.3	1.17
I consider myself a skilled user of information technology	0	0	1	2	11	10	4	5.48	0.98
I believe technology can have a positive effect on everyday social life	0	0	1	2	5	11	9	5.97	1.06
I am positive towards applying technology for social purposes	0	0	1	1	2	13	11	6.1	0.97

In the beginning of a typical session, the participants were asked to sign a form of consent, saying that they approve of the researchers taking pictures of them, and recording the video and audio from the sessions which would be used in a way that ensures their anonymity. Next, they were asked to fill in the background questionnaire which was described in section 5.3. Afterwards, participants were given smartphones with the *Who's Next* game installed, and were asked to play three rounds of the game. In the following and last part of the session, there was a group interview in which participants were asked to express their views about the game's concept and other specific matters.

The first session was considered to be a pilot session, aiming to obtain valuable knowledge that would help organize better and conduct more effectively the upcoming five sessions. The main difference between the pilot session and the rest of the sessions was in the gameplay phase, where the rules and guidelines given to the participants were less explicit, allowing them more room for improvisation. Additionally, the countdown timer was set to three minutes in every round, while in the other sessions was set to five minutes, since it proved to be too brief. Few of the questions that were used in the pilot session were proven to be somewhat inappropriate, hence a selection of what seemed the best questions from those shown in table 4.1 were used to create two sets of questions, labeled as '*Strangers*' and '*Friends*'.

In each of the other five sessions, the procedure that was followed was almost identical, with some small impromptu adjustments and alterations depending on the situation, which are not worth reporting. Typically the session began with the explanation of the game's mechanic to the participants, who were afterwards handed the smartphones and were asked to play three rounds of the game. The connection between the devices was established beforehand, and the countdown timer's duration as well as the set of questions used was already pre-set. The participants first had to provide answers to each of the eight questions that corresponded in each set. They were told that there are no right or wrong answers, and that their answers would not be recorded or used beyond the duration of the study session. In each session two of the question sets were used.

Figure 5.1 *The participants of the pilot session, answering the questions during the beginning of the first round.*

The first round was introductory, allowing the participants to familiarize with the game's logic and concept. When the active player was trying to figure out the name of the player who gave a particular answer to a particular question, that player could openly declare that it was him or her. It was pointed out to the participants that their performance (number of turns completed and mistakes made) would be taken into account in order to calculate a total group score. The group's final score would be then compared to those of groups from the other sessions, establishing an unofficial competition between the groups aiming to introduce the sense of collaboration and motivation for effective teamwork between the participants.

In the second round, the same set of questions and answers were used, meaning that the players did not have to provide answers again. However, the order in which the question-answer pairs would show up on the devices would be randomized afresh. This way, it was possible for question-answer pairs that had not been used in the previous round to be shown now, unless the group had managed to complete all turns previously. Although the questions and answers remained the same, one simple rule/restriction was applied, with the intention to change the players' behavior and the game's logic. The player who had given the particular answer that the active player was seeing on his/her screen, was not allowed to say the phrase '*it's me*' or clearly imply it in any similar way. Any other sort of communication, giving help or providing hints was allowed. Furthermore, the importance of the players' individual score was emphasized in this round, aiming to induce a competitive atmosphere among the players.

Figure 5.2 *The player on the left raising his hand and saying "it's me" during the collaborative first round.*

For the third and last round, the game was reset and a new set of questions was used, corresponding to an increased level of familiarity (asking participants to share somewhat more intimate information). The same rules as in the second round were applied. However, the participants were encouraged to pay attention to both their individual score and the group score, meaning that they should aim to perform better than their fellow players, but also prevent them from reducing the group's total score as much as possible.

5.3.2. Interview and Group Discussion

In the interview that followed playing the game, the participants were asked to honestly express their opinion and thoughts about the concept of the game in general, as well as their viewpoint on particular aspects and features. Next, they were asked to recall if they had participated in any ice-breaking or teambuilding activities in the past, and to compare them with *Who's Next*, pointing out advantages and disadvantages of the game.

The participants were then encouraged to provide their ideas on how the game can be improved or modified according to their preferences, either by changing some of its existing features, or by adding new ones that they would recommend.

Finally, it was asked from the participants to suggest contexts or use cases where an ice-breaking activity with the characteristics of *Who's Next* could be used, and would have a positive impact according to their opinion.

The interview was conducted in a way that the participants fell comfortable to sincerely convey their thoughts, even though they might be criticizing of the game's concept and the research. The questions were addressed to the whole group, and all the participants were encouraged to talk and freely express their thinking, without being led to any particular direction. Occasionally participants would interrupt someone who was answering a question to express their agreement or disagreement, often resulting in a discussion between the two participants, or even the whole group. The results of the interview are reported and analyzed in the next chapter.

5.4.   Summary

In order to evaluate the efficiency of the *Who's Next* game as an ice-breaking activity between strangers, but also to acquire useful feedback about its concept, a user study was conducted. A total of 61 volunteers applied to participate, out of which 28 were selected and divided in 6 groups of 4 or 5 people. The groups were formed so that they would include people of both genders and of different nationalities. All participants were university students or university staff, from 23 to 36 years old.

During the study sessions, which on average lasted for an hour, the participants played three consecutive rounds of the *Who's Next* game and were afterwards involved in a group discussion, where they were asked to express their opinion about it. The first round was collaborative, aiming to introduce the game's mechanics to the players, but also get them to familiarize with each other. The second and third round were more focused on competitive gameplay, applying the rule that players were not allowed to say '*it's me*'. The questions used in the last round were different and more personal than the ones used in the first two.

The recorded video and transcripts from each session were used to produce observations and conclusions about the game, which are described and analyzed in the next chapter.

6.   RESULTS

As mentioned in chapter 5, the recorded video and transcripts from the user study sessions were used to construct results, with the intention of deducing valid conclusions about the level of success of the *Who's Next* game. As mentioned in chapter 4, the results aim to determine how the game affects interaction between players and to what extent it can help them get to know each other. Additionally, the purpose of documenting and analyzing the participants' comments and opinions is to conclude how they interpret and evaluate the game's concept and design, as well as what are the additional features that can be added to the game, and how can the existing ones be modified in order to improve the user experience.

Two main methods are used to report and interpret the results from the user studies:

1.   Observing the participants' behavior while playing the game: This relates to the players' reactions to the different game modes and rules and the development of strategies to overcome them, as well as the social interaction between them.

2.   Discussing with the participants and asking for their opinion: All the important matters related to the game's concept and the participants' user experiences were discussed. Details about the group discussion are described in the previous chapter.

This chapter begins with the report on the players' in-game performance from each session. An overview of the all groups' scores in the different rounds of the game is given, followed by an attempt to interpret some noticeable patterns. Next, the various observations from the recorded videos are outlined, followed by the listing if the results from the group discussion. Then, various outcomes from the study are reported, such as the ideas and opinions of the participants about the potential future work based on the game's concept and a comparison between the two different gaming modes that were applied.

6.1.   Performance

The term '*performance*' refers to the number of turns completed and the number of mistakes made by the players during the game. These numbers were used to calculate the individual score of each player, as well as the accumulated score of the whole group. Along with the performance, the rules that were applied in each round are also taken into account, as well as the set of questions used in each case.

6.1.1. Report

Table 6.1   In-game performance for groups 2-6

Group #	Round 1	Round 2	Round 3
Group 2	Level: <u>Strangers</u> Rules: - Turns completed: 26 Mistakes: 2	Level: <u>Strangers</u> Rules: No "*it's me*" Turns completed: 26 Mistakes: 9	Level: <u>Friends</u> Rules: - Turns completed: 19 Mistakes: 11
Group 3	Level: <u>Strangers</u> Rules: - Turns completed: 19 Mistakes: 9	Level: <u>Strangers</u> Rules: No "*it's me*" Turns completed: 26 Mistakes: 17	Level: <u>Friends</u> Rules: No "*it's me*" Turns completed: 20 Mistakes: 14
Group 4	Level: <u>Strangers</u> Rules: - Turns completed: 35 Mistakes: 0	Level: <u>Strangers</u> Rules: No "it's me" Turns completed: 24 Mistakes: 18	-
Group 5	Level: <u>Strangers</u> Rules: - Turns completed: 29 Mistakes: 12	Level: <u>Strangers</u> Rules: No "*it's me*" Turns completed: 30 Mistakes: 22	Level: <u>Friends</u> Rules: - Turns completed: 30 Mistakes: 1
Group 6	Level: <u>Strangers</u> Rules: - Turns completed: 29 Mistakes: 9	Level: <u>Strangers</u> Rules: No "*it's me*" Turns completed: 30 Mistakes: 8	Level: <u>Friends</u> Rules: - Turns completed: 30 Mistakes: 4

Table 6.1 provides an overview of the performance of groups from sessions 2 to 6. The performance of the participants in the first group is omitted, since the duration of each round was different, and the rules applied were less strict.

6.1.2. Interpretation

The same set of questions were used in the first round and second round of every session, with the participants being required to give answers to the questions only once (in the beginning). However, in the second round they were not allowed to clearly declare that it was them who gave a particular answer, by using the phrase "it's me".

The mistakes/turns-completed ratio in the first round was below 0.5 for every group, with every player having fewer mistakes than his/her number of completed turns. This considerable success rate can be attributed to the fact that players were free to say anything to the active player and so helping them choose the correct name from the list. The mistakes made in this round were mostly associated with two factors:

1.   The active player was not familiar with the other players' names, and he/she was reluctant to directly ask them, thus risking to make a mistake.

2.   The active player would prefer to try his/her luck and attempt to make a '*wild*' guess.

In the second round, as expected, the number of mistakes made was increased significantly, mainly because of the fact that most players had to guess the correct answer at least up to a certain extent (more details in section 6.2). A noteworthy fact however is that the average number of turns completed was only slightly reduced (27.2 from 27.6 of the first round). That can be ascribed to the fact that players were more familiar with each other and could guess information about others quite successfully, or that they remembered some of the answers of their fellow players from the first round.

In the third round, for groups 2, 3, 5 and 6 a new set of questions was used, for which players had to type new answers. For groups 2, 5 and 6 no restrictive rules were applied, so this round can only be compared with the first one. Doing this comparison we observe that for the last two groups, the number of completed turns is higher, and the number of mistakes much lower than those of the first round, even though the questions can be described as '*harder*'. That can attributed to the fact that players were more familiar with the game's mechanics and logic, but it could also lead to the assumption that the level of communication and collaboration between them had been improved.

6.2. Observations

This section describes the participants' behavior throughout the different phases of the session, and the methods they applied in order to deal with various situations, such as the change of rules, or answering certain questions. Moreover, additional attention is given on the social aspect of the participants, focusing on the situations that ignited discussions and the cases that created a funny or even an unpleasant atmosphere.

6.2.1. Game Design and Rules

In the first round of each session, where no restrictions were applied, most of the times the active player would read the question and the answer out loud, and the player who had given that particular answer would clearly show that it was them. Sometimes however, the active player would try to guess the correct answer. In that case they would either just choose one of the names from the list (often resulting in a mistake), or they would directly ask the player they though was more likely to have given that answer. There were few occasions in the beginning of the game where players in their first turn were not sure of the purpose of the game, and would ask questions about what to do. After the first turn of being an active player however, the objective and mechanics of the game were clear to every participant.

As mentioned before, at some point in the game –typically in the second round- participants were not allowed to use the '*it's me*' phrase. That generally changed their behavior and the general atmosphere in the room. Participants were more focused on their phone's screen waiting quietly for their turn. The active player sometimes was just trying to guess the answer without asking for any help from the other players, often without even speaking at all. If the active player made a mistake and the corresponding sound effect was played from their phone, the other players would often giggle or laugh, but no conversation was initiated.

Most groups however interpreted this rule in a different way. The active player would read the question and answer out loud and would try to get some help or hints from the other players who would either point to the player they thought had given the answer or would say "*it's not me*". That resulted in a more pleasant and lively atmosphere compared to that of the sessions mentioned above.

An interesting strategy was developed by the participants of two groups, who tried to confuse the active player thus leading them to make mistakes and therefore reducing their individual score. That was accomplished either with bluffing by saying it was them who gave a certain answer (while it was not), or by pointing to other players. This often led to playful interaction within the whole group.

Figure 6.1 *First round of the game. The player on the left raises his hand to declare that it is him the active player (right) is looking for.*

The participants did not seem very concerned with the countdown timer of the game. The active player usually did not appear in a hurry to answer when the time was running out, and the other players very seldom expressed in a way that would urge the active player to play faster. However, the timer enforced a flow in the game which resulted in the completion of more turns and a more energetic pace, but which also created some undesirable issues. Several times, a discussion that had been initiated due to a certain question or answer was interrupted because the game would advance to the next player who was required to intervene. That often resulted in dividing the participants in two groups, one of which was paying attention to the game while the other one would be engaged in a conversation based on a previous turn.

Although the initial design objective of giving a negative-points penalty to the active player when making a mistake was to encourage interaction and team work, and to discourage wild guessing, it didn't always work as expected. Many players would choose to guess and risk making a mistake rather than discuss the question with the group, even though they spent more time thinking about it. In a few cases where two of the participants were familiar with each other beforehand, they were more eager to guess over a question that could be related to each other. When an active player made a mistake, he or she would express their disappointment, and the others would react, often by laughing or mocking them. In some cases where the active player made more than two or three mistakes due to guessing, some of the other players would try to encourage them to share the question with the group, in order to try and help.

6.2.2. Social Interactions

During the first few minutes of the sessions, participants were usually quiet and restrained, which was rather expected, since they were among strangers, in a research setting. In the first round, players remained quiet most of the time, pointing their attention to the active player who would usually read out loud the question and the answer on his/her screen (or often only the answer, especially if the same question had been shown before). Certain questions or answers sometimes led to a related short conversation between the players, and when the active player made a mistake, often other players would laugh or mock them. Most interactions though, during that first phase of the sessions evolved around the game.

Figure 6.2 *Players laughing after a funny answer.*

As the sessions progressed however, the various interactions between players increased in frequency. Especially while playing, but also during the breaks between rounds, there were more laughs, teasing and discussions. The atmosphere seemed friendlier since there was more "noise" in the room, and participants looked more relaxed. Unusual answers, which the active player did not understand, initiated conversations, with the active player asking from the player who had given that answer to elaborate on it. Also, when the active player was trying to guess an answer, especially during the second round when the restriction of not saying "it's me" was applied, different discussions would start, depending on if he/she managed to get the right answer. For example, when the active player was able to guess that the player who had answered "cricket" as his favorite sport was the only Indian in the group, another player was curious to know how he had guessed (cricket is India's most

popular sport), and when the active player made a mistake someone made fun of them by calling them a "loser".

A few cases were observed where two players had given the same answer to a question. When that happened during the first round, both players would say that it was them that gave that answer, and there was a small group discussion to decide what to do, resulting in the active player randomly choosing one of the two names. Sometimes, the way the answered had been spelled was different between the players, but no one from the participants considered asking about that, until they were informed by the researchers.

6.3. Group Interview and Discussion

The general opinion of the participants about the game's concept was positive, and the majority of their comments rather encouraging. Almost every participant agreed that the game was quite engaging and fun, and some claimed that it surprised them in a pleasant way, since it was much more amusing than what they had imagined when it was described to them. The average impression was that the game servers well its purpose as an ice-breaker, and that it makes people feel more relaxed with each other after playing four one or two rounds. Also, it was found to be very successful in learning the other people's names quickly, but also gaining some knowledge about the other participants' personal information.

This section reports and analyzes the results from the group discussion after playing the game from each session of the user study. The results are used to form aggregated conclusions about the game's design and its effectiveness in enhancing the participants' interaction.

6.3.1. Game's Design and Features

Regarding the questions that participants had to answer during the game, their opinion was often approving, but sometimes also criticizing. Most participants stated that sharing the personal information they were required to, did not make them feel uncomfortable or embarrassed: *"It's the kind of information that you can have access to from a LinkedIn or a Facebook profile. It's shared anyway"* - (Male, 26, Pakistani, Session 4). However there were also some who were a bit more skeptical: *"Age is something that people might not want to share"* - (Female, 22, Finnish, Session 2). The questions were found to be appropriate and fitting to the game's purpose, but there were also some suggestions for including more detailed or personal questions, especially for a group of already familiar people: *"If I suspect I can be friends with someone, I would ask them more specific questions to find out if we really have*

common interests" - (Male, 24, Pakistani, Session 6) and "*Truth and dare kind of questions would be nice for a group of friends*" - (Female, 27, Nepali, Session 1).

According to participants, the way a player answers a question would depend on their familiarity level with the others in the group "*My answers would be less serious if I was playing this with a group of friends*" - (Female, 29, Thai, Session 5). Additionally, the content of the answers and the way they are written affects the gaming experience and the overall fun aspect of the game: "*I wouldn't mind if others lie or give strange or stupid answers. It would spice things up and give some room for discussion*" - (Male, 34, Israeli, Session 3). Some argued that the question-answering phase at the beginning of the game takes too much time and it can feel awkward in a group of strangers, but others suggested that this issue can be overcome by the players themselves: "*Players should not overthink about what to answer, it doesn't have to be your absolute favorite band. Just something that indicates which kind of music you like.*" – (Male, 29, Mexican, Session 3).

As to how the use of a smartphone affects the user's experience, and the impact it has on the social interaction between the players, participants claimed that it makes the game more interesting and original, and adds excitement to the atmosphere. Most of them also seemed to believe that it did not affect the interaction in a negative way: "Using a smartphone doesn't limit the interaction between people, because you don't concentrate on your phone. You play the game, but on the same time talk to each other" – (Male, 31, Iranian, Session 4).

The participants' opinion about the two 'modes' of the game (collaborative and competitive) differed significantly; there were many who admitted to have enjoyed guessing for the correct answer, even if that meant risking a reduced individual score: "*It is more interesting to go after the unknown*" – (Male, 26, Iranian, Session 6), but there were also those who preferred cooperating: "*It is nice to receive help from others while playing*" – (Female, 23, Latvian, Session 3). A more detailed comparison between these two ways of playing can be found in section 6.4.

6.3.2. The Social Influence of Who's Next

As mentioned earlier, participants found the game successful in serving as an ice-breaking activity between strangers. While sharing personal information with a group can be intimidating, doing it through the phone is much easier: "*It makes interaction between strangers easier, at least for the start*" – (Male, 35, Thai, Session 4), and "*Players can share information with the whole group at the same time*" – (Male, 27, Spanish, Session 1). It was also agreed that the game can be easier for shy people and introverts to open up to strangers.

Initiating a conversation because of what was written in one of the answers was an aspect of the game that participants noticed to occur frequently. That was something that participants seemed to value considerably in a group activity: "If I find someone who likes the same specific thing as me (e.g. a game) there would really be a connection between us" – (Male, 27, Syrian, Session 4).

Apart from breaking the ice and initiating conversation between strangers, one of the objectives of the game was to help people learn some basic information about the others, with the expectation that it would make them feel more comfortable and familiar with each other. One thing that was obvious even from observing the participants play, was that they were able to memorize each other's name quickly. In the beginning of session 6, one of the participants took the initiative to ask for everyone's name before playing, which resulted in everyone introducing him or herself. However when the game begun, most of the players did not remember the others' names and had to ask again. After playing a few turns of *Who's Next* however, all players were able to remember the names of the others without having to ask again until the end of the session. According to participants seeing the name written on the screen helps in memorizing it.

In addition to remembering the names, the game helped participants in memorizing some information about the others: "*You get to know the other players' interests*" – (Male, 23, Indian, Session 5). This, in combination with the experience from the game and the interactions it caused made the participants feel more familiar with each other: "*I don't consider the other players strangers after playing this game with them*" – (F, 24, Chinese, Session 3). However, there were those who thought that the questions asked in the game were too shallow in order to make one feel like knowing the other: "*In order to actually know the others, the questions need to be different*" – (Male, 26, Iranian, Session 4) and "*If I want to know someone better, knowing his favorite movie or food, at the end of the day won't make any difference*" – (Male, 26, Iranian, Session 6).

6.3.3. Comparison with Traditional Ice-breaking Activities

Participants were asked to recall situations where they had been among strangers with whom they had to interact, and they were required to through a certain process in order to get to know them. If they claimed to have participated in an ice-breaking or group-building activity, they were particularly asked to describe it and then compared it to the *Who's Next* game.

The most common experience among the participants was that of sitting in a circle at the beginning of a class or some similar group session, where every person had to introduce him or herself to the group. That method was described both as unpleasant

and unsuccessful. Participants said that having to be the center of attention in a group of total strangers and talk about oneself can feel terrifying especially for shy people. With the *Who's Next* game however, sharing that information required little effort, since all that players had to do was type it on their phones "*When you have to introduce yourself to a group it feels too serious, because you think about the impressions you will make on others. But if you play a simple game like this, it would make people feel more relaxed*" – (F, 27, Bangladeshi, Session 6). The other problem with the "circle method" is that after a few people have talked about themselves, it is hard to remember what everyone has said, while with *Who's Next* helps one memorize information about the others: "*I have a good introduction about the other player*" – (Male, 26, Pakistani, Session 4).

Another advantage of *Who's Next* over traditional ice-breaking activities is that it is can be set-up very easily and quickly, and it doesn't require a "facilitator" (a person who would explain the procedure to everyone else and be responsible for organizing the activity). A possible drawback is that it requires participants to own a smartphone, but as one participant pointed out: "*Nowadays, almost everyone has a smartphone*" – (Female, 23, Latvian, Session 3).

Although the majority of participants seemed to believe that *Who's Next* is a successful approach towards finding a way to improve existing ice-breaking activities, there were those who expressed their doubts and dissent: "*I believe talking is the best way to meet someone you don't know*", and "*I prefer to introduce myself to people by talking face to face*" – (Female, 22, Finnish, Session 2). While the game provides the common ground and motivation to initiate a discussion, it is an indirect way of introducing oneself to the others, without forcing oneself to talk in order to present his or her personal information.

6.4.   Collaboration Versus Competitiveness

The applied rule of not being allowed to use the "*it's me*" phrase, along with the introduction of the individual and group score and the encouragement towards participants to focus on improving them, practically separated the gameplay in two modes, the collaborative and the competitive. Examined by the user experience perspective, but also from the perspective of the impact on social interaction, there are advantages and disadvantages in each mode.

The collaboration between the players mostly occurred during the first round, where everyone could express themselves freely and help the active player. In this part of the game participants were more talkative, and the atmosphere was lively and friendly. The players who were waiting for their turn would usually look at the active player and generally more conversations took place. Some participants seemed to prefer that

over the competitive mode: "*I found the collaborative mode more interesting because I could just talk to people*" (Male, 29, Indian, Session 5) and "*When collaborating you get to know more about the others*" (Male, 29, Mexican, Session 3). But there were many who found it less exciting and even boring: "*It feels like cheating*" – (Female, 36, Finnish, Session 1) and "*saying 'it's me' would only be interesting if players don't know each other's names*".

Figure 6.3 *Above: Collaborative round. Players look at each other.*
Below: Competitive round. Players are concentrated on their screen,
waiting until it is their turn.

Even though interaction between the players was significantly reduced during the second round, when the restrictive rule was applied, many participants preferred it. They stated that they found it more challenging, which made the game more fun and

exciting: "*I consider the second part of the game (competitive) the thrilling part*" – (M, 26, Iranian, Session 6) and "*The competitive mode is more like testing your intuition and ability to guess things about the othe*rs" – (Female, 27, Bangladeshi, Session 6). Although the groups' performance could imply otherwise, some participants claimed that guessing helped them memorize other people's answers and get to know them: "*When you're trying to guess what the other person likes, then you get to know it. It helps you memorize it*" – (Male, 23, Indian, Session 5) and "*If you just complete the whole game by getting help from others, you won't remember anything*" – (Male, 24, Pakistani, Session 6). Additionally, it was noticed that players who later stated that they preferred the competitive mode, were trying to guess the correct answer even when saying "it's me" was allowed.

7. DISCUSSION

Mobile technology and internet connectivity are now ubiquitous, allowing people to share their personal information and communicate with their peers. However, mobile devices are rarely used to initiate or enhance interaction between strangers that are within each other's proximity, and can often be intrusive and even create barriers between friends.

As illustrated in chapter 2, video games are exceedingly popular software applications, which have been proven to have a positive impact on the players' sociability, leading to the formation of interpersonal relationships between them through large online communities, but also by facilitating face-to-face interaction between collocated people.

Chapter 3 pointed out that interaction between strangers in their first encounter can often be inhibited by various factors. Activities called icebreakers have been developed to overcome those obstacles. They are usually games or playful exercises which aim to make the group members feel more comfortable with each other by having fun or sharing personal information. Technology has been successfully used in several such cases, like for example using a shared display in a group to increase awareness collaboration.

Based on the above, the purpose of this thesis was to design, implement and evaluate a playful ice-breaking application for collocated mobile devices, which would utilize the advantages offered by technology and the success of existing ice-breaking activities. The result was *Who's Next*, a multi-player quiz-based game for collocated strangers in their first encounters, in which players provide answers to personal questions, and then take turns in trying to find the correct player behind a given question-answer pair.

In order to evaluate the effectiveness of *Who's Next* as an icebreaker, a user study with six sessions and a total of 28 participants was conducted. The participants were asked to play 3 rounds of the game with varying rules and questions, and then were interviewed to express their opinion and thoughts about the game's concept and design.

Referring to the list of categories of ice-breaking activities mentioned in chapter 3, the *Who's Next* game can be labeled as a stationary icebreaker, but it also combines several aspects from various other categories. The fact that players can see the answers that others gave to personal questions promotes the "get-to-know-you" factor. The collaboration between players in order to accomplish a common goal

(improve their group score and compete with other groups) promotes team work, which is a characteristic of team-building activities.

7.1.   Summary and Interpretation of the Results

Observing the participants' behaviour while playing the game, and analyzing their feedback from the interview led to the conclusion that *Who's Next* was an engaging and pleasant activity, which contributed positively in warming the atmosphere in a group of strangers. Additionally it provided an effective means for the players to effortlessly share their personal information with the group, and an efficient way to help them memorize information and names of the other players in the group. While in the beginning most participants would extensively think on what to answer (sometimes even asking the researchers for advice), as the game progressed they behaved in a more playful way. Often players gave bizarre answers, just to make the game funnier or to amuse –and in some cases confuse- their fellow-players.

The first part of a typical session of the user study aimed to introduce the players to each other and to the concept and mechanics of the game. That was later labeled as the 'collaborative' mode, since players were free to openly declare it was them who had given a certain answer to the certain question. During that phase, a considerable number of discussions occurred, which mostly originated from the game's questions or the players' unusual or funny answers. The participants managed to learn each other's names very quickly, and the atmosphere in the room became livelier. According to what they said, the game provided them with a basic idea of the other participants' interests and character, who they would now not describe as strangers anymore.

In the next round, the restrictive rule of not allowing players to say "*it's me*" was applied. That introduced the notion of competitiveness and altered the atmosphere within the group. Players were answering mostly by guessing, trying to detect hints in the other players' behaviour. Inactive players mainly focused their attention on the screens of their devices waiting for their turn, and interactions within the group them were mostly limited to some laughs and comments, especially when someone made a mistake. Although the effects of this change of rules were interpreted as a dissociation from the game's original purpose, many participants found the 'competitive' mode more interesting and amusing; some even claimed that it had a positive impact to the ice-breaking aspect of the game, since trying to guess an answer would help them memorize it, thus getting to know the other players better.

While the game was effective in getting strangers to know each other in a playful way, it was also perceived as a fun past-time activity that could be used in many occasions and contexts, such as between close friends at a gathering or a party. As the

participants mentioned, it can also be used as a team-building activity that would promote cooperation between co-workers. That can also be concluded by the fact that various collaboration strategies and techniques were developed by players, who often tried to indirectly help each other answer the questions correctly.

As it was proven by the results, the game was successful in breaking the ice between strangers, introducing a comfortable and pleasant feeling between them. This was a result of alleviating some of the inhibiting factors of social interaction between the players (3.2.1), The fact that the players were able to share their personal information with the whole group without having to draw the group's attention to them, bypassed the shyness element. The various circumstances that occurred during the game created the motivation and initiative to interact, which are usually missing among strangers. Finally, the players' answers to questions about their hobbies and preferences, provided the common ground for discussion which is often absent between people that meet for the first time.

7.2. Design Reflections

As mentioned earlier, the design of the *Who's Next* game was a result of an iterative process aim create an application that would aid social interaction between strangers, and at the same time providing an efficient way for its users to get to know each other. In order to accomplish that objective, several design decisions were made, the effectiveness of which is discussed in the current section.

The players' performance within the duration of a game round (number of turns completed and mistakes made) were recorded and used to calculate their final score. There were two kinds of scores: the individual and the group score. The purpose of the individual score was to encourage players to perform better than the other players of the same group, motivating them to memorize other players' answers, and trying to understand their hints and implications during the competitive rounds. Although some players did mind their individual score and said that their resolve to increase it affected their behaviour during the game, most players did not pay much attention to it. A reason behind this could be that the score was not visible to the players before the end of the game. Additionally, besides the sound effects and phone vibration, there was not any visible feedback that would correlate the effect of their actions on their score. What is more, the individual score seemed to increase the sense of competitiveness among the players, thus leading to reducing interaction between them.

The purpose of the group's score was different; it aimed to motivate all group members to act as a team and to collaborate effectively, even when restricted by the rules of the game. The group score received a bit more attention than the individual

score; there were some references to it from certain players, urging the other group members to reduce their number of mistakes. Although it was mentioned to them that the final accumulated group scores would be compared between the study sessions to determine the best group, that did not seem motivating enough for the participants, probably because there was no way for them to see the results of that comparison.

The game focuses on enhancing social interaction during the two first of the stages in the development of a relationship that are mentioned in chapter 3: Acquaintance and buildup. During the first stage, the initiation of interaction between the players is the key factor. The playful and ice-breaking aspect of the game facilitates the advancement of that stage, by creating a comfortable atmosphere among strangers, and by providing "food" for discussion between them. The buildup phase is based on gaining knowledge about the other's personality and the mutual gain of trust. The gaining of knowledge is done through the memorization of the other players' answers to the game's questions, justifying the existence of the quiz element in the game. Trust comes through effective collaboration and team work, which can make the players realize that they can rely on each other in order to accomplish a common goal.

The players' answers were often the reason for a conversation between the players, mainly because of the multi-culturality of the groups, but also because of some participants' playful attitude. The design choice that contributed mostly towards that direction was the "free text" form of the answers, meaning that players were able to type anything they wanted. Although that made some of the players somewhat hesitant when answering, especially in the beginning of the game, and led to an extended duration of the question-answering phase, it proved rather beneficial. It also provided the players with the option to avoid answering a question that would make them feel uncomfortable or embarrassed.

Most traditional ice-breaking activities are conducted without the use of any electronic device or software. *Who's Next* utilizes the use of smartphones, demonstrating a way that they can be used effectively to promote and enhance social interaction, and not act as barriers that separate people from each other, as they are often perceived (Slade 2012). That feature however can make the game inaccessible to certain groups of people who do not own such devices (e.g. in undeveloped countries) or who are not familiar with using them (e.g. elder people).

7.3.   Methodological Reflections

The methodology that was applied in order to evaluate the effectiveness of the game as an icebreaker proved to be rather fruitful. The feedback gathered from the participants was adequate to create valid conclusions about the concept. The study sessions could be more successful however, if they were organized and planned in a

more structured way, aiming to produce more quantitative and straightforward results. In particular, every section should consist of the same number of game rounds, using exactly the same questions and better-defined rules. That would increase the validity of conclusions formed by comparing the differences in the in-game performance between groups. It would also provide the opportunity to focus on other aspects and characteristics of each group, such as the level of multi-culturality and age variance, and examine whether (and to what extent) they have affected the participants' behaviour and developed strategies.

The methods used to gather data about the participants' behaviour and opinion (observation and interview), provided adequate qualitative information, which made possible the forming of valid conclusions about the game's social impact. A quantitative approach however, could have been proven useful as well. For example, asking the participants to fill-in a second questionnaire after playing the game, with a focus on their impression of the game, would provide the opportunity to assess the game's effect on their opinion about the use of technology as a means of socializing.

7.4. Conclusions and Future Work

Overall, the design process of *Who's Next*, can be considered a successful attempt in exploring how to utilize mobile technology to create an effective ice-breaking activity for a group of strangers. The final concept featured elements that could provide effective solutions to several of the issues that were pointed out during the study of the theoretical background, relevant to the challenges during the formation of groups and interpersonal relationships. Additionally, the playful approach, in combination with the use of modern technology and accredited gamification elements, suggests substantial enhancements to the traditional methods and practices.

Regarding the game's concept itself, *Who's Next* was acknowledged as an engaging game, serving its purpose as an icebreaker, which can be adjusted and used in a variety of situations. According to the participants, a similar activity could be effectively utilized in a working environment in order to introduce the new employees to the rest, or in a classroom in the beginning of an academic year.

The process of constructing conclusions about the concept's level of success can be benefited from further iterations of the evaluating procedure, in different contexts and with different parameters. For instance, user study sessions could be applied to different age or culture groups, in different settings and occasions and with more diversity in the level of familiarity between the participants. Additionally, giving the participants the ability to insert their own questions in the game, or choosing which ones to use from a pre-defined list could produce valuable results.

Both of the two gaming 'modes' applied in the studies had advantages and disadvantages. A way to combine the amusement caused by the competitiveness and unpredictability of the guessing approach, with the increased interaction brought by the collaborating mode, would add up to the overall engagement of the game, and would satisfy users of both preferences. Moreover, a significant improvement to the mechanism of the game would be to involve all players in the decisive action that takes places in each turn, so that they wouldn't feel bored or left out while waiting for their turn.

Finally, regarding the technical aspect of the implementation, there are several additions and modifications that would improve the general performance of the game. Although the utilization of the Wi-Fi Direct framework provides several advantages (see 4.3.1), there seems to be a practical upper limit to the number of devices that can be connected at the same time. Additionally, the practices used in the development do not match the best practices for the latest versions of the Android APIs (21) suggested by the Android development community, which would improve both the stability and the compatibility of the application with the majority of available devices.

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APPENDIX A: USING TEXT STYLES IN MS WORD

This appendix includes the material used in the user study: the background questionnaire that was handed to the participants before playing the game, and the list of questions that were asked to them during the group interview.

A.1 Background questionnaire

Please take a few minutes to answer the following questions to help us better understand your background. We will use this information only to provide background and usage context in which to interpret the input and feedback you'll give us in the user study. We will keep your name confidential, and anonymously report the information you provide today.

1. First Name: _____
2. Age: _____
3. Gender (M/F):   _____
    4. Nationality: _____

- Please indicate with a √ in the (   ). In the last <u>month</u>, how often did you:

a. <u>Use a smartphone:</u>

( ) I don't know what that is	( ) Never	( ) Once	( ) Sometimes	( ) Frequently

b. <u>Use a social platform/website:</u>

( ) I don't know what that is	( ) Never	( ) Once	( ) Sometimes	( ) Frequently

c. <u>Play a mobile game:</u>

( ) I don't know what that is	( ) Never	( ) Once	( ) Sometimes	( ) Frequently

d. <u>Play a multiplayer game:</u>

( ) I don't know what that is	( ) Never	( ) Once	( ) Sometimes	( ) Frequently

- Please indicate with a √ in the (   ). In the last <u>year</u>, how often did you:

e. <u>Participate in an "ice-breaking" activity with a group of strangers:</u>

( )	( )	( )	( )
Never	Occasionally	Frequently	Very Frequently

f. <u>Have to interact with people you had not met before:</u>

( )	( )	( )	( )
Never	Occasionally	Frequently	Very Frequently

g. <u>Played a game with your friends/colleagues/family:</u>

( )	( )	( )	( )
Never	Occasionally	Frequently	Very Frequently

What kind of game (if any)? _____

- Please indicate (with a √ on the number) how you agree with the following statements. (1 = strongly disagree, 4 = neither agree or disagree, 7 = strongly agree):

• I consider myself a social person	1 2 3 4 5 6 7
• I enjoy meeting new people	1 2 3 4 5 6 7
• I have no problem when it comes to making new friends	1 2 3 4 5 6 7
• I consider myself a skilled user of information technology	1 2 3 4 5 6 7
• I believe technology can have a positive effect on everyday social life	1 2 3 4 5 6 7
• I am positive towards applying technology for social purposes	1 2 3 4 5 6 7

- I use one or more mobile devices in my everyday life: Yes / No

A.2 Discussion questions

- How well do you know each other?

- What is your first impression and general opinion about the application? What do you think about games that reveal your personal information to others, or result in you learning things about them?

- What do you think this application adds to general ice-breaking activities? What does it lack? How does it affect social interaction?

- Can you think of a context/case where this application could be used?

- An in-game feature we considered was that the players would be able to define their own questions before the start of the game. What do you think of that? What kinds of questions would you add? Examples

- Were there any questions or parts of the game that you would describe as inappropriate, or that made you feel uncomfortable?

- Do you have any ideas/suggestions about the application?

APPENDIX B: USER STUDY ADVERTISEMENT

The text used in the online advertisement of the user study is shown below. The participants would use the link to get directed to an online form, where they would answer some background questions and insert their contact information.

Try out our new game and join our group discussion to get a movie ticket

Nov 11, 2014 16:14

Come try out our new game for a group gathering!

In the user study (which will last approximately 1 hour), there will be a game demo which you will be asked to play, followed by discussion and feedback about the game. By participating, you will get a Finnkino movie ticket as a thank you token.

If you are interested, just signup here:
https://www.webropolsurveys.com/S/F802628E926A1A1A.par

In this survey, please fill in your background information and select the time slots that would be okay for you. We expect the participants to speak English well enough to be able to answer and discuss in English.

A researcher will contact you afterward to set the date and location.

For any questions, please feel free to contact: aris.malapaschas@student.tut.fi