



TAMPERE UNIVERSITY OF TECHNOLOGY

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USER EXPERIENCE OF PROXIMITY-BASED SOCIAL
NETWORKING

Master of Science Thesis

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ABSTRACT

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Social media is a growing phenomenon. Social network sites (SNS) are web services which are designed for supporting the communication between the users. One of the most famous SNSs is Facebook with over 500 million active users. This indicates that people are interested in using social media in their everyday lives.

Social networking has gradually gained ground also in the mobile technology. Today, mobile phones are more sophisticated than earlier, enabling the use of various communication methods. Modern mobile devices contain technologies like Infrared (IR), Bluetooth and WLAN, which allow the interaction between the users in proximity. Social proximity applications (SPA) are mobile applications which can exploit these technologies and bring social networking to the mobile context.

TWIN is a social proximity application developed in Tampere University of Technology. This thesis investigates the usage of TWIN and proximity-based communication from the viewpoint of user experience. The thesis is based on a large-scale user trial, called TWIN pilot and its results. Two months long trial with 250 participants made it possible to study user experience of proximity-based social networking in-depth and in a long term. The main aim of the user study was to find out how people use proximity-based technology for communication purposes. For achieving the aims that were set, various research methods were used during the trial.

Results indicated that people are interested in using proximity-based technology, especially for communication with their existing social network. Also, meeting strangers with the help of the technology was seen useful and fun. The peer-to-peer technology contains some challenges, which are significant to solve in the future. The overall feedback of TWIN was positive and encouraging, and thus the further development of proximity-based applications can be seen significant.

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Sosiaalinen media on kasvava ilmiö. Sosiaalisen verkostoitumisen sivustot (SNS) ovat web-palveluita, jotka ovat suunniteltu tukemaan käyttäjien välistä kommunikointia. Yksi suosituimpia SNS:iä on Facebook yli 500 miljoonalla aktiivisella käyttäjällään. Tämä viittaa siihen, että ihmiset ovat kiinnostuneita käyttämään sosiaalista mediaa heidän jokapäiväisessä arjessaan.

Sosiaalinen verkostoituminen on vähitellen saanut jalansijaa myös mobiiliteknologiassa. Nykyään matkapuhelimet ovat kehittyneempiä kuin ennen, mahdollistaen erilaisten kommunikointimenetelmien käytön. Modernit mobiililaitteet sisältävät teknologiaa, kuten infrapuna (IR), Bluetooth ja WLAN, jotka mahdollistavat käyttäjien välisen vuorovaikutuksen läheisyydessä. Sosiaaliseen läheisyyteen perustuvat sovellukset (SPA) ovat mobiilisovelluksia, jotka voivat hyödyntää näitä teknologioita ja tuoda sosiaalisen verkostoitumisen mobiiliin kontekstiin.

TWIN on sosiaaliseen läheisyyteen perustuva sovellus, joka on kehitetty Tampereen teknillisessä yliopistossa. Tämä diplomityö tutkii TWIN:n käyttöä ja läheisyyteen perustuvaa kommunikointia käyttäjäkokemuksen näkökulmasta. Diplomityö perustuu laajaan TWIN pilot -nimiseen käyttäjätestiin ja sen tuloksiin. Kaksi kuukautta kestävä testi 250 osallistujan kanssa mahdollisti läheisyyteen perustuvan sosiaalisen verkostoitumisen käyttäjäkokemuksen tutkimisen syvällisesti ja pitkällä aikavälillä. Pääsiallinen tavoite käyttäjä tutkimuksessa oli selvittää kuinka ihmiset käyttävät läheisyyteen perustuvaa teknologiaa kommunikointitarkoituksiin. Saavuttaakseen asetetut tavoitteet, useita eri tutkimusmenetelmiä käytettiin kokeen aikana.

Tulokset osoittivat, että ihmiset ovat kiinnostuneita käyttämään läheisyyteen perustuvaa teknologiaa, erityisesti olemassa olevan sosiaalisen verkoston kanssa kommunikointiin. Myös ennalta tuntemattomiin henkilöihin tutustuminen teknologian avulla nähtiin hyödylliseksi ja hauskaksi. Vertaisverkkoteknologia sisältää joitain haasteita, jotka on tärkeä selvittää tulevaisuudessa. Yleinen palaute oli positiivista ja rohkaisevaa, joten läheisyyteen perustuvien sovellusten jatkokehitys voidaan nähdä tärkeänä.

PREFACE

Since I was a little boy, I have always felt interest towards technology and the possibilities that it is bringing with. When I found usability studies at Tampere University of Technology, I was sold on. What would be more interesting than the studying of the interaction between human beings and technology?

I was more than happy when I got an opportunity to combine my interests and studies at my work in the Unit of Human-Centered Technology. This thesis formed from the TWIN project, which was conducted as collaboration between Tampere University of Technology and Nokia Research Center.

The thesis concludes my seven years long studies in Tampere University of Technology. Although the lectures were sometimes deadening and studying was hard, I would not change a day. The journey has been long, but very teaching and satisfying.

Without a strong collaboration and the help from several wonderful people, this work would not be finished. First, I wish to thank professor Kaisa Väänänen-Vainio-Mattila and Niko Kiukkonen for being examiners of the thesis. I want to thank Minna Wäljas for her help during the user trial phase and her advice. Also, I want to thank Susanna Paasovaara for giving support during the writing process. I want to thank my parents, who have always pushed me further in my school career. To my dad's everlasting question "Aren't you yet graduated?", I can finally answer "Yes, dad, I am".

Last, but not least, I want to thank my beloved Sanna. Thank you for understanding and giving me support during the challenging work process.

I want to dedicate this thesis to my loved grandma, who recently passed away. She taught me something about the joy of life.

Tampere, June 29th, 2011

Petri Saarinen

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ABBREVIATIONS

Ad hoc	a Latin phrase meaning “for this”. In a networking context it is used for describing a system which does not require any pre-existing infrastructure, like routers or access points
Bluetooth	Wireless technology standard for transferring data over short distances
Familiar Stranger	A person who that we regularly see but do not interact with
HCI	Human-Computer Interaction
IHTE	Unit of Human-Centered Technology
IR	Infrared
Maemo	A software platform which is developed for smartphones
MMS	Multimedia Messaging Service
N900	A smartphone manufactured by Nokia
P2P	Peer-to-peer, a network model which is based on peers
PDA	A Personal Digital Assistant
S60	Symbian OS based software platform for mobile phones
SMS	Short message service
Symbian	An operating system (OS) and a software platform
TUT	Tampere University of Technology
UX	User Experience
Wiki	Web site, which can be modified by users
WLAN	Wireless local area network

1. INTRODUCTION

This thesis is based on the research and results of the user study which was carried out by the Unit of Human-Centered Technology (IHTE) in a trial called TWIN pilot. TWIN pilot was a part of TWIN project which was conducted in cooperation between Nokia Research Center (NRC) and Tampere University of Technology (TUT). The aim of the user study was to study how proximity-based technology in mobile context can be used for communication and what kind of experiences the use provokes.

1.1. Background

Nowadays, social media is one of the most growing phenomena in the field of ubiquitous technology. Social network sites (SNS) are web sites which support social networking between the users (Boyd & Ellison 2008). One of the most famous SNS is Facebook, which has more than 500 million active users worldwide (Facebook 2011), and the number is still increasing. People are clearly interested in using technology for communicating and creating social relationships between other people.

Social networking has spread gradually over mobile technology. First mobile phones allowed users to call and send SMS. Today, mobile phones are more powerful than before, including various new features and enabling different kind of communication. Modern smartphones are equipped with wireless networking capabilities, such as Infrared (IR), Bluetooth and WLAN, allowing user to connect to other mobile phones in proximity. Social proximity applications (SPA) are applications which are developed for communication between the users in proximity (Persson et al. 2005). These applications offer a completely new way to keeping touch with existing friends and meeting new people. Furthermore, social proximity applications enable new usage patterns and use contexts for the users of mobile phones.

This thesis focuses on proximity-based communication from the viewpoint of user experience. The main motivation was to study how people use proximity-based technology for communication purposes and what kind of experiences the use provokes. The thesis is based on a large-scale user trial called TWIN pilot and the user study which was carried out during the trial.

1.2. Objectives and methodology

The aim of the user study was to find out how participants would use proximity-based TWIN application and how the application would function with a large number of users. Communication in proximity with a mobile application is something new to all and therefore it was interesting to study what kind of expectations participants would have, how these are met and what kind experiences the participants would get during the trial. Two months long user trial with 250 participants made possible to study user experience of the proximity-based communication in a long term.

Before the beginning of the user study, research methods were considered carefully. The goal was to study user experience widely and research methods had to support this concept. There was a need to get both, qualitative and quantitative user data. Since the trial was considerably large including a large amount of participants, web questionnaires were considered as a good way to get data comprehensively and easily. It was considered that three web questionnaires, which would be published at the beginning, during the trial and at the end, would be enough for capturing user experience widely. For getting quantitative data, 30 participants were interviewed at the end of the trial. In addition to these methods, participants were able to share their experiences in a specific web forum, which was opened for them during the trial. Furthermore, anonymous user log data was collected for getting statistical data.

1.3. Structure of the thesis

This thesis divides into three main parts. The first part consists of the following two chapters. In these chapters two essential topics related to the theme of the thesis are presented; proximity-based communication and user experience. Proximity-based communication is examined in depth, as it is the starting point for the whole thesis. Social media, social networking and technologies which are enabling communication in proximity are discussed. Furthermore, several proximity-based applications are presented as an example of the real-world implementations. User experience is discussed in the next chapter. Various definitions and evaluation methods for user experience are presented.

The second part (chapter 4) introduces the empirical side of the thesis. A large-scale trial called TWIN pilot and the user study which was conducted during the trial are presented widely. The mobile application (which was used during the trial), practices of the trial and users are also presented. Furthermore, the user study process and research methods are described in detail.

The last part of the thesis (chapter 5 and chapter 6) describes the results of the user study and presents the conclusions of the thesis. Results are categorized by various themes which are presented in their own sections. The main findings are presented in the end of chapter 5. The last chapter summarizes the thesis and presents the conclusions based on the most significant findings. Results are also discussed and compared with the literature. Furthermore, some visions of the future work are discussed.

2. PROXIMITY-BASED COMMUNICATION

This chapter introduces the field of proximity-based communication. Various technologies and practical implementations related to subject are presented.

2.1. Social networking

Social media is one of the growing phenomena in the field of ubiquitous technology. Kaplan & Haenlein (2010) define social media as a collection of Internet-based applications that are based on Web 2.0 which enables the creation and sharing of the user-generated content. It seems that nowadays people are using applications of this kind in their everyday life for keeping touch with their friends.

2.1.1. Social networking in desktop context

Boyd & Ellison (2008) call the web sites that support users' social networking as *social network sites (SNS)*. Their exact definition contains three elements. SNS are services that allow users to

- 1) “*construct a public or semi-public profile within a bounded system,*
- 2) *articulate a list of other users with whom they share a connection, and*
- 3) *view and traverse their list of connections and those made by others within the system.*”

These sites have become a part of daily practices for many people nowadays. SNS primarily support users' communication with their existing social networks, but some sites also help meeting strangers using the common interests as an aid. Furthermore, there are social network sites that are based on common language, race, sex, religion or nationality. SNS can be classified according to the key features that they offer, like mobile connectivity, blogging and photo- and video-sharing. (Boyd & Ellison 2008)

Boyd & Ellison (2008) mention that allowing users to meet strangers is not the thing which makes these sites unique, but enabling users to reveal and make visible their social networks. This may lead to interaction between users that would not otherwise occur. However, it seems that users are not necessary using SNS for meeting new

people, but for communication purposes with their existing extended social network. (Boyd & Ellison 2008)

The key feature of social network sites is *profiles* and displaying them to *friends* who are particular users of the same service. The profiles are personal web pages where users are described for public. The description is usually generated from various questions that users are asked in the joining stage. The profiles include general information about the user, such as age, location, interests and a profile photo. The friend term in SNS means another user whom the user has a relationship. The term can vary depending on the service. Other used variants are “contact” and “fan”. The interaction in social network sites usually functions by using *comments*. Comments are messages that users can write and left to another users’ profile. Private messages are available also on most sites. (Boyd & Ellison 2008)

Lee et al. (2009) divide social networking sites in three categories: *the indifferent social networks*, *niche networks* and *business-oriented social networks*. The first category includes services such as MySpace, Facebook and Orkut. These services treat all users equally, without any preferential treatment. Niche networks are limited for a general audience. The networks of this kind have a specific scope in which the users of the services are interested in. Lee et al. give Within3 as an example of a niche network. It is focused on advanced health sciences, and thus the users are mostly physicians and health researchers. Registration to Within3 is restricted and users have to be invited to be able to join the network. Last category consists of the networks which are designed for business usage. LinkedIn and Plaxo are examples of the networks of this kind. It is mentioned that the business-oriented social networks can be very effective in marketing purposes. (Lee et al. 2009)

2.1.2. Social networking in mobile context

Social networking is not limited to web sites. Humphreys (2008) introduce *mobile social network systems (MSNS)*, which help users to be connected each other by using mobile phones. These services allow users to create, develop and strengthen relationships in mobile context. Humphreys compares that mobile social network systems (MSNS) are almost like social network sites (SNS), as both help users to network with other users for sharing information and content.

Liu et al. (2010) categorize mobile social network systems into three categories based on the evolution path of the services. First group includes MSNS which are designed for primarily using a desktop computer, thus the mobile use is not involved so strongly. In other words, these are SNS with mobile connectivity. The services of this kind can benefit from the huge user group of desktop computer users. The second group consists of MSNS which are limited on the mobile use and support for desktop usage is not

available. Last group includes MSNS that are designed for mobile phones but also need desktop usage for functioning completely. Dodgeball (Humphreys 2008) is one example of mobile social network sites in this group. (Liu et al. 2010)

Liu et al. (2010) have compared MSNS with SNS. They have found three features that exist mostly in MSNS. First of all, mobile social network sites offer *location based service (LBS)* to users which enables location tracking based on GPS information. This feature has been described as “*killer application*” in MSNS. The use of location information allows systems to help a user to meet other users within the user’s current location. The second feature relates to *more secured identities*. Users in mobile context are bounded with their phone numbers. According to Liu et al. identification based on phone numbers would help users to create more reliable relationships with other users. Third feature is *instant property*. MSNS offer users the instant messaging, so messages can be sent to whenever and more important, to wherever the users are. This is not limited to messaging only, but other features like file sharing as well.

Liu et al. (2010) emphasize that SNS games are today extremely popular. These are now spreading in the mobile context which encouraged Liu et al. to develop their version of MSNS game. This is further discussed in section 2.3

2.2. Proximity-based communication

Proximity-based communication means the usage of technology for the communication purposes in a situation where participants are each other nearby. There are available various technologies which can be used for this kind of communication. Today’s modern mobile phones are equipped with wireless networking capabilities which make possible to connect to devices around. Mobile technologies, such as *Infrared (IR)*, *Bluetooth* and *WLAN* allow information sharing between people’s mobile devices inside the range.

Mobile technologies are nowadays more focused on supporting people’s social life. Mobiles phones, especially SMS (Short Messaging Service) and MMS (Multimedia Messaging Services) have affected the way of communication between the people. Smart phones and PDAs (Personal Digital Assistants) have brought the web services available in the mobile use. One of the new technology novelties is combining positioning technology and short-range network capabilities to create mobile services which are able to adapt to user’s physical and social context. (Soulakshmee 2010)

Persson et al. (2005) argue that with specific software, mobile devices which are equipped with wireless technology such as Bluetooth or WLAN can be used for broadcasting and fetching information from other users nearby. In this particular situation information is transferred directly without any network structure or servers. Persson et al. use term “*Social Proximity Applications*”, *SPA*, when speaking about applications that can be used for communication with other people in proximity. They compare the use of social proximity applications and common human behaviors in public spaces; it should not be the main purpose to push information (they called it as digital identity expression) onto others but rather pulling more information from people nearby.

Hall (2008) describes three different ways how mobile ad hoc peer-to-peer systems can be used. First, such systems allow information sharing between different devices carried by meeting people. Secondly, the information available by using ad hoc peer-to-peer systems could affect individuals’ lives, for example people could get recommendations for content like media and information or places to go. Third way which was mentioned was helping people to get more awareness of other people nearby, for example by sharing their interests. (Hall, 2008).

Collaboration between people in proximity is also one aspect which is studied in the literature. Holmquist et al. (1999) define the term *Inter-Personal Awareness Device (IPAD)* as a hand-held or wearable device which supports awareness and collaboration between people in near proximity. IPADs can be used in any location since the devices are not dependent on any networking infrastructure, but the data transfer is made directly between the devices. The key feature of IPAD is the noticing of other users. The device is used mainly to initiate a contact and the interaction followed after is done otherwise. Holmquist et al. argue that with the help of IPADS people can work more effective in modern work situations.

Before going into technologies for proximity based communication, the traditional way for networking is illustrated shortly. The traditional *client-server model* in networking means the network architecture, which consists of a server and a single or multiply clients. The model is used on the Internet and on local area networks (LAN). A server provides resources and services which the clients are requested. In this model, clients are usually PCs, but mobile devices can function as clients as well. Figure 1 (the right part) illustrates the client-server model. (Mitchell 2011)

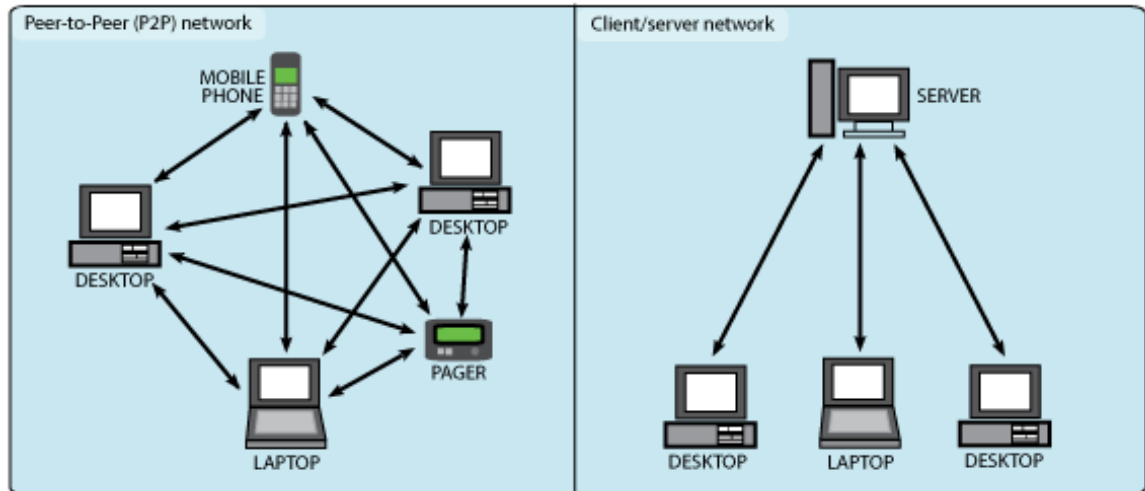


Figure 1: The P2P model (left) and the client-server model (right) (ThinkUKnow 2011)

The client-server model is only one approach to networking technologies. A fairly different approach is *peer-to-peer* (P2P) architecture. In P2P model, all devices of the network are equal and a server device does not exist. This means that devices are connected directly each other and data transferring can be done without any intermediary. Figure 1 (the left part) illustrates the peer-to-peer model. P2P is more flexible than a client-server model, especially when the network is growing and a large amount of devices exist. (Mitchell 2011; Schollmeier 2002)

2.3. Proximity-based applications

Various proximity-based applications have been studied in the literature. There have been several user studies though nearly without an exception, the focus in these studies has been on usability, privacy matters or the application use, such as the frequency of usage. More in-depth user experience has been studied slightly.

Persson et al. (2005) have studied to how information in digital real can support and augment social behavior, practices and experiences which occur in real space. They present a mass-scale longitudinal field trial where they evaluate proximity-based application called *DigiDress*. DigiDress is a precursor prototype to Nokia Sensor application (Persson & Jung 2005). The user trial included 618 participants who used the application for 25 days on average. DigiDress is an open expression tool suitable for various social encounters and use contexts. The application runs on the S60 platform and uses Bluetooth technology for wireless communication. Participants were able to install DigiDress on their own S60 phones. The application offers various features, like a profile creating, Bluetooth messages for private communication, comments for public communication and Lookaround (illustrated in Figure 2), which scans the environment for other users and shows them in a list. DigiDress allowed phone-to-phone distribution as users were able to distribute the application to non-users. Developers thought that this

kind of distribution was critical to the trial as it could make the adoption of the application much easier. (Persson et al. 2005)



Figure 2: User interface of DigiDress (Persson & Jung 2005)

Developers of DigiDress did not want to limit the application for any specific user group or use situation. The aim was to allow users to create media identity expressions, in addition to finding others' expressions nearby and browsing them with a mobile device. Results of the user trial indicated that the participants created both serious and playful identity expressions. The nature of these expressions was both revealing and non-revealing. (Persson et al. 2005)

Plummer et al. (2008) present *CampusWiki*, a service which integrates location-based information into a wiki structure. CampusWiki can determine the location of the users in the service and display that information in a customized for each individual user. Plummer et al. conducted two user studies to find out users' attitudes and reactions to Campuswiki. According to results, several benefits and concerns related to the service were found. Often mentioned positive things included locating other people in the campus area, being informed about events and getting help for decision making situations. Users were concerned mostly about privacy in the service, the credibility of information and misuse. Overall, users seemed to be willing to use the service of this kind.

Eagle and Pentland (2005) discuss *mobile match-making*. They introduce a mobile match-making system called *Serenditipity*. The system allows users to make a profile (Figure 3) and describe the attributes of the people they are looking for. By taking the information given into account, the system detects people in proximity and alerts the users if there is someone in their proximity who might be interesting. This alerting system is based on the specific "similarity score". It is calculated by comparing users' profiles and taking users' defined weights into account. If the score is higher than the threshold given by both users, the system announces the users that there is someone near who might be interesting to meet.



Figure 3: A profile in Serendipity (Eagle & Pentland 2005)

Eagle and Pentland mention that until 2005, Serendipity has been tested and iterated for almost one year. The first time the system was proposed for 40 users in a day-long conference. The feedback from these users was studied and based on this information, developers made changes to the system. The current version has been evaluated with one hundred users from two university departments on the MIT campus.

Lovegety (Iwatani 1998) is a Japanese matchmaking service that originated by Takeya Takafuji with his colleagues. The service consists of a mobile device which enables wireless communication with other similar devices. Lovegety allows users to describe their interests in a profile and as the device meets other device with matching similarities, it alerts the user that there is a matching user nearby. Takafuji tells that in two and a half months they have shipped approximately 350 000 Lovegety devices. Although the demand for the device is high, it seems that the critical mass has not yet achieved, since users have told that the system has suffered from the lack of users. This has affected the use, as users tend to stay in certain areas which are well-known and in favor with other Lovegety users.

The research has indicated that today young people in Mauritius tend to stay single for longer than earlier (Republic of Mauritius 2008). Soulakshmee (2010) supposes that one possible reason for the change is that the people focus more on their career and work than their social life and finding partners. To help the situation, Soulakshmee propose the design of an adaptive social application, *BDATE*. It aims to make social interaction between people easier with the help of a proximity-based technology. Currently, a prototype of the system has been implemented and evaluated with 50 test users. Based on the evaluation, *BDATE* is found to be very intuitive and easy to use. 95% of the users were interested in using *BDATE* to find out people compatible with themselves. Soulakshmee believes that *BDATE* is able to enhance the real-time communication as people can make new acquaintances with their mobile devices, and being in front of the computer screen is no longer needed. He mentions that in future it is significant to ensure that *BDATE* is available on all types of mobile devices.

Humphreys (2008) introduces *Dodgeball*, a MSNS which aims to facilitate a social connection among friends in public spaces. Humphreys tells about social and behavioral norms of Dodgeball use which is based on the year-long qualitative field study conducted in 2005-2006. The field study included participant observations and in-depth interviews. Results revealed that participants benefit from Dodgeball in various ways. They coordinated face-to-face meetings among their friends and exploited social-location information, for example if they know that some of their friends were near, they could join their company. Humphreys mentioned the more friends in a specific location the greater the pull to meet up with them. By this way, Dodgeball created a kind of collective experience and movement of social groups. Dodgeball was one of the first larger MSNS, as it was used in over 20 cities in the US. Later Dodgeball was acquired by Google which discontinued its development in 2009 (Gundotra 2009). However, the idea behind did not disappear, as *Google Latitude* succeeded Dodgeball soon after its shutdown (Goel 2009).

Google Latitude was developed for answering the question “Where are my friends right now?”. It is a feature for Google Maps application supporting both mobile and desktop usage. Users are able to share their location with the other users and the service illustrates this information on the map view. Google Latitude is available in 27 countries, which tells something about the popularity of the service. (Google Blog 2009)

Page & Kobsa (2010) discuss the real-world adoption of Google Latitude service. They have studied the users’ location sharing with 21 users using semi-structured interviews and grounded theory as research methods. The results of their study indicate that many users are feeling pressures to adopt social applications including location-sharing. Also, the necessity of being responsive and accessible all the time was considered as stressful. (Page & Kobsa 2010)

In section 2.2 was discussed IPADs and their effect on collaboration in modern work situations. *Hummingbird* is a small physical device equipped with a radio transceiver which enables a user to be aware of other users in proximity (Figure 4). The device helps a user to notice other members of a certain group by giving visual and auditory signals. According to Holmquist et al. one problem with face-to-face communication is being unaware where other people are located. For example, the arrangement of a group meeting can be time consuming. Hummingbird is developed to help in the situations of this kind by bringing the awareness of other people’s locations. Holmquist et al. tested Hummingbirds in various situations. Results indicated that Hummingbirds were useful in the office environment though the most beneficial use occurred in the unfamiliar settings. It seemed that the environment that is unfamiliar to people offers only a little support for communication and therefore Hummingbird can help users in the situations like this. Holmquist et al. emphasize that Hummingbird succeeded in increasing the

awareness between group members and complementing other means of communication such as calling and emailing. (Holmquist et al. 1999)



Figure 4: A user carrying Hummingbird device (Holmquist et al. 1999)

Paulos and Goodman (2004) bring different aspect to proximity based communication. They argue that today's mobile communication tools connect us to our friends and familiars already but the connection to strangers is still missing. For this reason, Paulos and Goodman have investigated how people could extend their relationships with *Familiar Strangers*. Familiar Stranger is a social phenomenon which appeared for the first time in psychologist Stanley Milgram's essay in 1972 (Milgram 1972). According to Paulos and Goodman, the term describes other people that we regularly see but do not interact with. They described several experiments and studies on which basis they developed the device called *Jabberwocky*. Mainly, the idea was to exploit these devices for helping people to notice others who visit regularly in the same locations.

Jabberwockies can be carried by users or attached to fixed locations like bus stops (Figure 5). As two users who are carrying Jabberwockies meet, the devices detect each other and record the meeting. Paulos and Goodman called user traces of this kind as *digital scents*. Similarly tracing works in places where fixed Jabberwockies are located. This kind of tracing where places are beaming unique and detectable identity is called *digital tagging*.

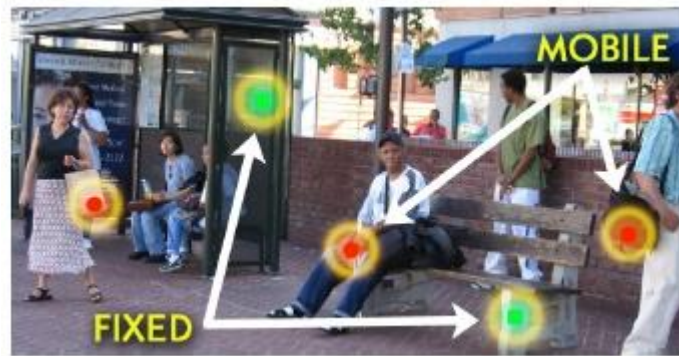


Figure 5: Fixed and mobile Jabberwockies (Paulos & Goodman 2004)

Liu et al (2010) have surveyed 100 college students for getting requirements for a mobile social interaction platform. Students had various requirements and ideas for a new platform. It appeared that the system should contain registration for ensuring the identity of a user. A personal page which shows user's characteristics and a feature for blogging were also requested. Half of the students seemed to be willing to share their feelings and thoughts by blogging. A game concept related to a mobile social network site aroused interest among the students. It appeared that the students were eager to use social interaction games to maintain their social relationships. The more traditional manners of social interaction by using internet on a desktop computer were seen mostly disgusting and the students had a lot of interest towards mobile use which would allow more in-depth social interaction and face-to-face meetings.

Based on the requirements, Liu et al. (2010) developed a system for social interaction, called *Mobile Hunter System*. It aimed to expand users' possibilities of interpersonal relationships. In addition to web based usage, Mobile Hunter System allows mobile use, so face-to-face meetings with other users are possible. The system contains four key features; a personal page, a friend management, a blog and a geographic location-based game. The personal page is for sharing personal information with other users. Also, the relationships with other users are illustrated in the personal page. With friend management, users can search and add a specific user to their friend list. The blog feature contains tools for blogging and sharing instant feelings and moments with other users. Liu et al. describe the game feature as the most significant part of the application. The game feature includes team play characteristics, thus users have to cooperate and use social skills with other users. According to Liu et al. this kind of group collaboration expands the communication between people and boosts the development of social relationships. The system was tested with small-scale usability tests. Results indicated that Mobile Hunter System was entertaining and it helped people to extend their social networks. People seemed to be attracted to gaming in a mobile social network system. (Liu et al. 2010)

Esbjörnsson et al. (2003) propose a mobile peer-to-peer application for social interaction between motorcyclists, called *Hocman*. The application is meant for handheld devices (the hardware is illustrated in Figure 6) equipped with wireless networking options. The main purpose was help motorcyclists in traffic encounters which usually are brief and fast. Users are able to create personal profiles in service (Figure 6). Hocman automatically exchanges data between motorcyclists when they pass each other. Bikers can use the information later for getting more in-depth knowledge about other bikers they met during the drive. All information is gathered to log (Figure 6). Esbjörnsson et al. evaluated the application in a small field test with six users. According to the results, Hocman enhanced the enjoyment of driving.



Figure 6: The handheld device used (left), a user's profile (middle) and log feature (right) (Esbjörnsson et al. 2003)

Comm.unity (Aharony & Zigelbaum 2009) is a proximity-based software framework which is still in development. The goal of the development process is to create proximity aware applications which would encourage communication between the users. The system exploits wireless technology and as all the data is transferred directly from a device to another device, there is no need for any servers or administration. *Comm.unity* supports various device types and wireless technologies, such as WLAN, Bluetooth and IR. It seems that there is not any trial or user study conducted yet.

3. USER EXPERIENCE

This chapter focuses on user experience (UX), discussing its wideness, challenges of defining the term and introducing some existing definitions. Several methods for user experience evaluating in various contexts are discussed.

3.1. Defining user experience

In the field of human-computer interaction, usability-related research has gradually changed more towards the research of user experience. Whereas usability focuses on the interaction of user and user interface, user experience measures feelings, expectations and other more emotional matters as well. Defining UX in a comprehensive way is difficult as it is such a wide term gathering all aspects of user's interaction with a specific product or service in a specific use situation.

Law et al. (2009) present several reasons why it is challenging to define user experience in a universal way. First they mention the wide range of UX term. As user experience includes emotional, affective, experiential, hedonic and aesthetic matters, which are usually dynamic and fuzzy variables, it is hard to define the entirety. Second, UX gathers the aspects from a single end-user's interaction to the aspects of all users' interaction with the whole organization and its services, which is challenging on the perspective of analysis. Last, they mention the fragmented field of user experience research, which is complicated by various theoretical models focusing on pragmatism, emotions, experiences, values, pleasure, hedonic matters and various other topics. (Law et al. 2009)

Despite the challenges of defining, there are various user experience definitions available. Formal ISO standard (ISO 9241-210 2010) defines user experience as “*A person's perceptions and responses that result from the use or anticipated use of a product, system or service*”.

Nielsen Norman Group (2011) describes UX as a term which covers all aspects of the end-user's interaction with the company and its products and services. The needs of the customer have to meet carefully for achieving high-quality user experience. Nielsen Norman Group emphasizes that products which are delivered to customers should be a joy to own and a joy to use. At a company level, effective co-operation between

engineering, marketing, graphical, industrial and interface design is needed. (Nielsen Norman Group 2011)

Hassenzahl and Tractinsky (2006) review UX term from three perspectives. They present that user experience can be studied from the facets of *emotion and affect*, *the experiential* and *beyond the instrumental* (Figure 7).

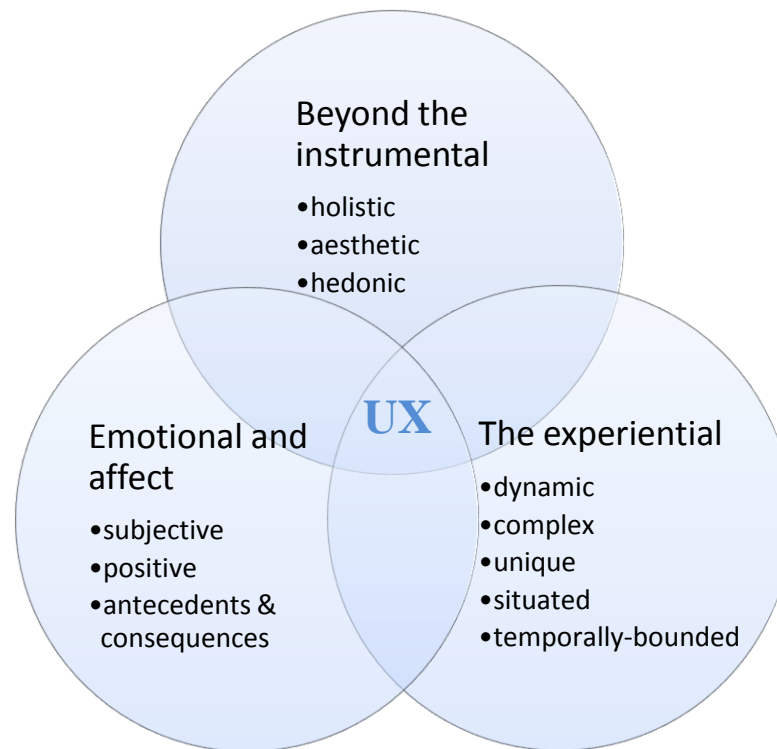


Figure 7: The facets of UX according to Hassenzahl and Tractinsky (2006)

First facet is called “beyond the instrumental”. Hassenzahl and Tractinsky mention beauty as an example of the thing which cannot be measured by instruments. It has intrinsic value and it satisfies a general human need. Beauty is more like an end than a means. There has been discussion (Gaver and Martin 2000) about the importance of non-instrumental needs. In addition to beauty, there are needs such as diversion, surprise and intimacy, which are difficult to measure by any instruments. Hassenzahl and Tractinsky emphasize that for getting better product quality, non-instrumental needs have to be understood and defined.

According to Hassenzahl and Tractinsky “emotional and affect” is another important element of UX. Whereas the affective computing takes a “computer” perspective, user experience is taking the more humane one. Hassenzahl and Tractinsky present that “[UX] is interested in understanding the role of affect as an antecedent, a consequence and a mediator of technology use. In addition, it is rather focused on positive emotions”. They remind that one of the goals in HCI has always been preventing the

frustration and dissatisfaction of users. However, the user experience research is more on positive emotion-related matters such as joy, pride and fun.

“The experiential”, as a third facet, is consisted of two aspects of technology use: the situation of technology usage and its temporality. User experience can be perceived as the combination of a product and an internal state of the user during the specific moment. Hassenzahl and Tractinsky emphasize that the product, the internal state of the user and the use situation are elements which are interacting and modifying each other. These elements form the term that we called “an experience”.

Hassenzahl and Tractinsky conclude that none of the presented facets fully describe user experience. UX includes subjective, situated, complicated and dynamic matters and therefore it is difficult to define exactly. According to them, user experience consists of the user’s internal state (such as needs, expectations and mood), the properties of the used technology (such as usability, complexity and functionality) and finally the context where the interaction happens.

One of the latest discussions for defining UX is in User Experience White Paper (Roto et al. 2011). The paper contains several core concepts and perspectives of UX, which a group of leading user experience researchers and practitioners have seen the most significant. They present three perspectives in which user experience can be viewed;

- 1) *UX as a phenomenon*
- 2) *UX as a field of study*
- 3) *UX as a practice*

First, UX is a phenomenon, which can be described. It is possible to identify the different types of user experience and find out the circumstances and consequences related to it. Second, UX is a field of study including the research about the forming of experiences, designing means and methods for developing UX design and evaluation. Last, UX can be seen as a practice. Envisioning in design practice, a prototype building, UX evaluation and UX aimed designs are all in the scope of this perspective. (Roto et al. 2011).

Roto et al. present several benefits from an exact description of user experience. A well definition would help the teaching of the user experience, communicate the meaning of UX term to others, merge different research perspectives of UX, contribute the whole research field and improve practical user experience work in commercial, industrial and government sectors.

3.2. Methods for evaluating user experience

Isomursu (2008) has studied the user experience evaluation in the context of technology trials. She mentions that the user experience research is usually demanding and when studies are conducted outside of a laboratory, the situation is even more challenging as it is not possible to fully control the real-world setting. Other difficulties are related to the human nature. An experience is always a subjective matter and therefore difficult to analyze objectively. Isomursu tells that using *relevant parameters* for evaluating user experience is the way to successful analysis. The user experience is also dynamic as it can evolve or alternate during the time. A good example of this is the feeling of enthusiasm and first flush when getting a new product, which still may fade away when time passes. The dynamic state of user experience requires studies which are conducted in *long-term*. Isomursu categorizes user experience methods into four evaluation phases:

“(1) methods used before the pilot, (2) methods used during the pilot, (3) methods used immediately after the pilot and (4) follow-up studies.”

Isomursu (2008) emphasizes that each evaluation phase has specific goals and focuses. Before-use evaluations provide information about users' attitudes and expectations. Furthermore, it sets the starting point for the study in order that the measurement of changes and evolution can be conducted later. Evaluation methods during the trial are used for studying the adoption of the technology at the beginning and collecting data about the user experience at the time it occurs. Isomursu et al. (2007) tell that the user experience evaluation during the trial should be integrated into the everyday practices of the users, keeping the evaluation process as invisible as possible. Otherwise users may unnecessarily pay attention to the evaluation process and the technology is not more in their focus. In that case, the evaluation results might not be realistic. Isomursu (2008) adds that the evaluation done during the use can also focus on how the technology affects users' life. After the trial, users are familiar with the technology and usually at this point a feedback survey is conducted. Storytelling is another method which is used for reporting user experience. Follow-up studies are for estimating the long-term effects of the trial. Isomursu mentions that users' attitudes can change with time and the change does not end necessarily after the trial.

Isomursu emphasizes that when evaluating user experience, it is significant to collect information at the time when the experience is just formed. The need for relying on users' memories should be avoided. Evaluation should be done in realistic usage situations, so users do not have to imagine their experiences. Lastly, we should use direct subjective information given by users who have the experience, in order to get as exact a definition and measurement as possible. (Isomursu 2008)

There are available various research tools for evaluating user experience. “All About UX” website (All about UX 2011) compiles over 70 methods which can be used depending on the study setting and evaluation goals. Methods are categorized in four different ways; by the type (such as field and lab studies), by the development phase (such as scenarios and prototypes), by the studied period of experience (such as before and during the use) and by the evaluation provider (such as single or multiple users). These research methods can vary each other much, as four examples below show.

One of the most common used research methods is questionnaires. Both quantitative and qualitative data can be collected by using this method. The most ordinary questionnaire type is certainly the questionnaire delivered on a paper though there are several other types of questionnaires, such as web questionnaires, mobile questionnaires, telephone questionnaires and email questionnaires. According to Valli (2007), the choosing of a questionnaire type should be based on the target group and the aim of the research. Heikkilä (2010) states that a web questionnaire is one of the fastest ways to collect data though using it requires a suitable sample in available. Both, Heikkilä and Valli mention that the planning of the questions for questionnaires has to do carefully. The formulation of questions is especially significant as misunderstood questions cause most mistakes to research results.

Interviews are in the large role when speaking about studying deeper user experience. The method is usually used for getting qualitative data. In an interview situation the interviewer and interviewee are interacting directly each other. For that reason, interviewer’s behavior and relevant being has a significant meaning in addition to well-planned interview questions. A polite and pleasing behavior motivates the interviewee to answering questions and usually a best outcome is achieved in this way. An interview is a more flexible and a less predetermined research method than a questionnaire. Questions can be repeated, put in a various order or elaborated more if needed. In this way, a response rate can be higher than in other methods (even 90-100%). (Heikkilä 2010)

AttrakDiff is a free of charge questionnaire, which is designed for measuring hedonic and pragmatic user experience. It is a research method focusing on the attractiveness of an interactive product. *AttrakDiff* is based on the word-pairs of opposite adjectives, which a respondent can select for indicating his experience of a particular product. The method can be used for collecting quantitative data. (Hassenzahl et al. 2011; All about UX 2011)

Discussing emotions that a particular product is arousing is challenging. Sometimes users are even embarrassed when they are asked to express their emotional responses. One slightly different research tool is *Emocards*. It is a non-verbal method which allows users to self-report their emotions related to the evaluating product. Users can describe

their emotions by selecting a specific cartoon face card (Figure 8). 16 Emocards present eight various emotional expressions for both genders. The left side of the circle contains expressions for unpleasant emotions and the right side for pleasant ones. This kind of research method is not expensive and it is easy to use for evaluating user experience. (Desmet et al. 2001; All about UX 2011)

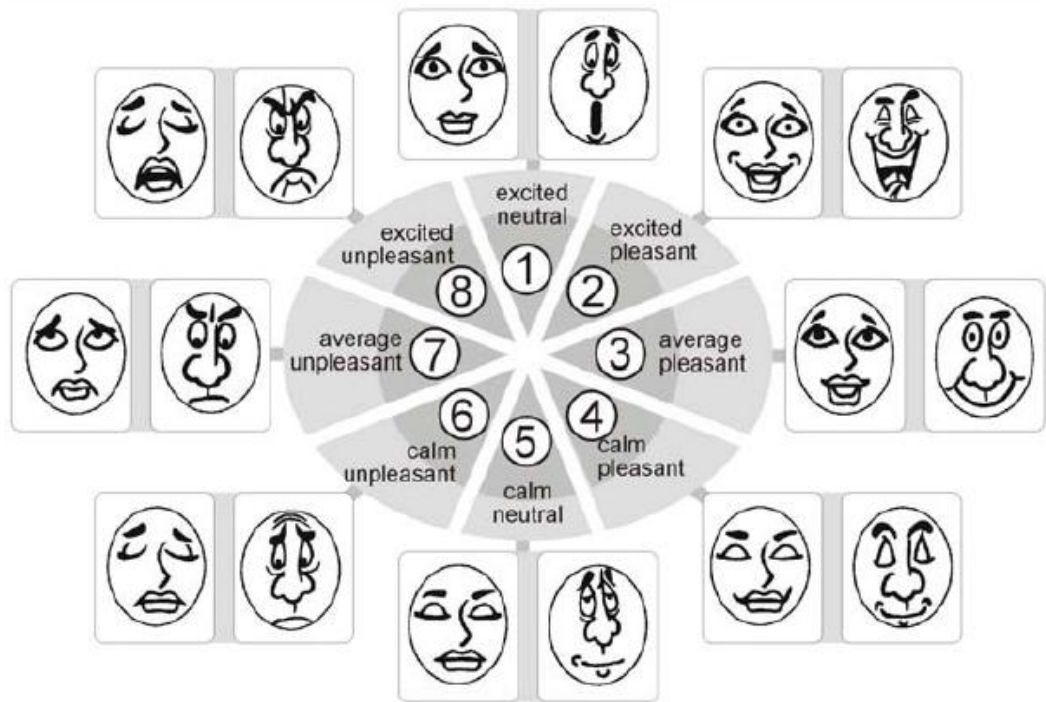


Figure 8: Emocards (Desmet et al. 2001)

3.3. Summary

User experience is a wide term. In spite of the challenges of defining it, various definitions exist. Definitions and research perspectives vary, but some similarities can be found. Generally, UX can be said to include all the interaction between users and the specific organization and its products and services. Researched things related to user experience do not limit on practical issues, but emotional matters are on the significant role as well. Various guidelines for evaluating user experience have been discussed. It is emphasized that evaluation often requires collecting the data at the time when the actual experience is formed. Furthermore, several research tools for evaluating UX in different contexts were discussed shortly in this chapter.

4. THE USER STUDY IN TWIN PILOT

This chapter introduces a large-scale user trial called *TWIN pilot* and the user study which was carried out during the trial. TWIN pilot was a part of TWIN project, which started at the beginning of 2008. The project was conducted as a collaboration between Tampere University of Technology (TUT) and Nokia Research Center (NRC). As a result of this project, a mobile application called TWIN was implemented (TWIN 2011). TWIN pilot was carried out to find out how the application would function with a large amount of users. The main goals of the user study were studying the user experience of TWIN application and finding out how people would use proximity-based technology for communication purposes.

4.1. TWIN application

TWIN is a social proximity application developed by the Department of Computer Systems in Tampere University of Technology. The concept is designed for mobile use and it is implemented in N900 mobile phones on Maemo platform. The main idea of the application is support people's communication in proximity. TWIN application automatically searches for other users nearby and creates a local community, grouping all who are physically in proximity.

Users are able to send group or private messages to other users who are within the range of the network. Furthermore, file sharing, a message board and a specific radar feature for exploring the surroundings are available. Most of these features are functioning automatically, thus user's attention is no needed. When changes in proximity are detected or new messages are received, the application alerts a user visually or using a vibration.

4.1.1. User interface

The user interface of TWIN is simplified and straightforward. It is designed for touch screen use with a stylus or a finger. The home view of the application is introduced in Figure 9. The communities where user has joined (currently "twin" and "Testi") are listed on the left side of the home screen. The right side of the home screen contains various communication features. *Community* feature is for managing communities, *Chat* for instant messaging, *Filesharing* for sharing and downloading files and *Msg board* for reading and posting messages to the message board.

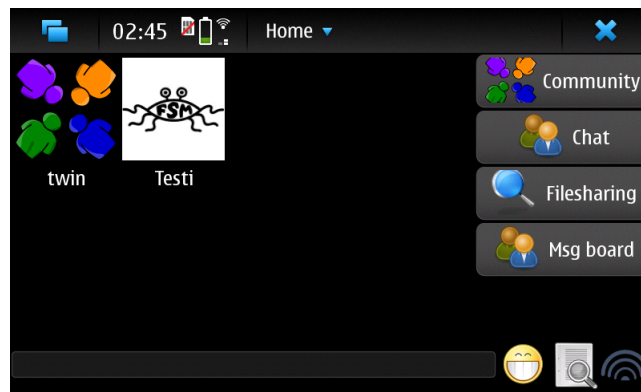


Figure 9: Home view

The bottom of the screen contains a *status bar*, a shortcut to *status changing*, *events* and *radar* feature. The status bar indicates of other users' new actions, like status changes. Status changing allows a user to choose a smiley which describes his current feelings. The events feature is a log tool which lists last actions that have occurred in TWIN network. Radar is for visually tracking of other users in proximity. The home screen includes also a shortcut (on the right corner of the screen) to a chat view if a user has an active chat open (visible in Figure 10). The color of the shortcut will change to red when a new message is received.

Communities are one of the main features in TWIN. They are groups which are formed from the users who are near each other. As TWIN does not support any specific user roles, like moderators or administrators, all users are able to create communities and join them. Communities can symbolize meaningful things to users and therefore gather users who have common interests together. The community which is named as "twin" is an exception. It is generated by the system and it automatically gathers all users in proximity its inside. Users are able to send messages to all others nearby by sending their messages to "twin" community. Figure 10 illustrates the view inside "twin" community. Users are listed on the left side of the screen. A chat conversation can be started by choosing the user and clicking the chat button on the right. Sharing a file or using a message board functions in the same way.

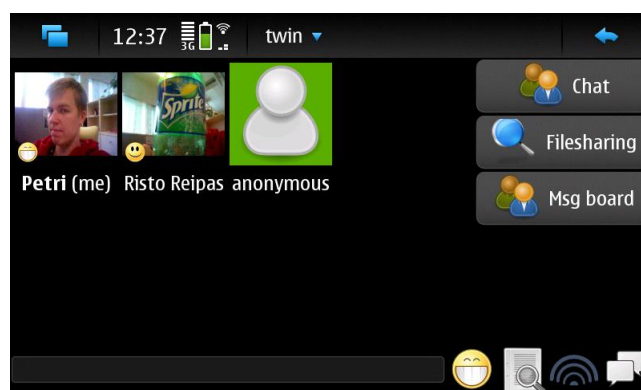


Figure 10: Community view

Communication in TWIN is based on the chat feature. It allows a user to chat with other users in proximity with instant messages. A user can use either private messages, which are delivered to a specific user, or community messages, which are delivered to an entire community. Figure 11 shows the messaging view with two active chats open with user “Heikki” and “twin” community. Like earlier was mentioned, chat messages to “twin” community will be forwarded to all users in proximity.

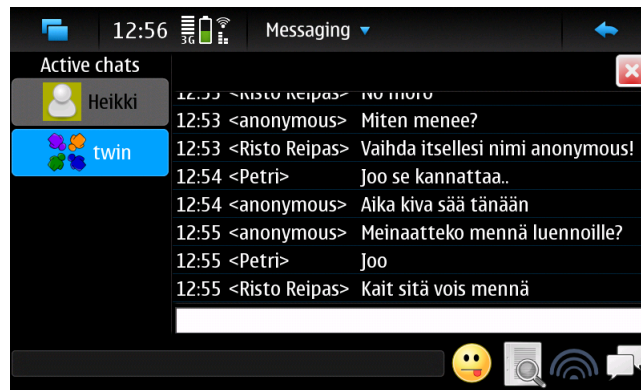


Figure 11: Messaging in TWIN

The radar view (Figure 12) is a graphical abstraction of users in proximity. The view shows other users that are current within the range of communication and the distance to them. Distances are represented using hops between the users as a unit of measurement. Figure 12 describes the situation where two users are within the range of one hop, so the direct connection to them is possible. Users which are two hops away (connection is routed via users between) are represented on the second (light grey) arc. The outer arc (dark grey) is for users who are three or more hops away.



Figure 12: Radar view

Sharing files like music, photos or videos, is possible with TWIN. The filesharing feature allows a user to publish, upload and download files. When publishing files, they are marked as available for downloading by other users. Uploading is a direct way to send a specific file to other user. Receiving files is not automatic, but user has to confirm that he likes to receive a file from other user (Figure 13). Like with the chat messages, file sharing can be conducted with a single user or a whole community.

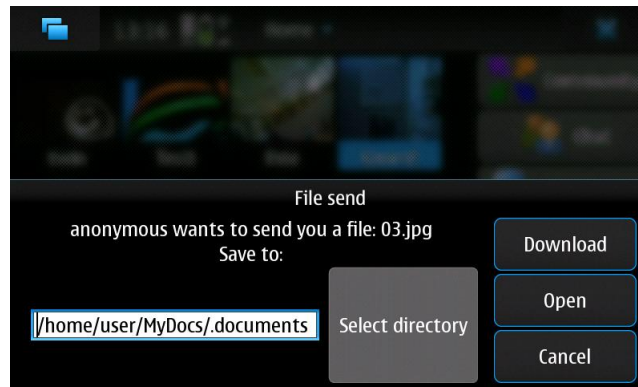


Figure 13: File receiving

Message board is a feature for public announcements. It is a simplified version of an Internet forum (vBulletin 2011), allowing message reading, composing and searching features to a user. The feature can be used for example for sharing selling advertisements. The view of message board is illustrated in Figure 14.

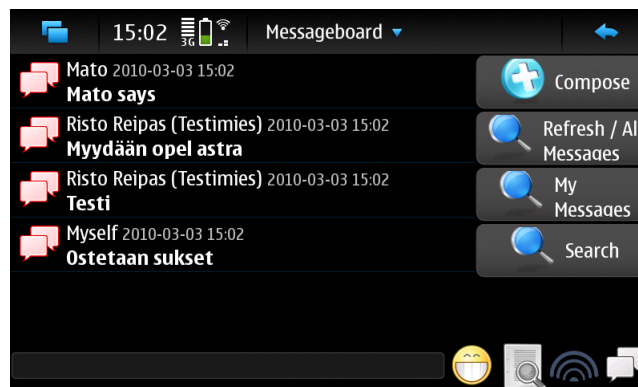


Figure 14: Message board view

TWIN supports self-expression by profiles. Users are able to create a profile which describes them in the way they like. Every user has a personal profile, but filling it up is optional. User's nick is an exception, as it is the only mandatory field. However, it can be something like "anonymous", if a user does not want to share his identity. Profiles consist of the following fields: nick, name, age, gender, description, city, state, country, birth date, e-mail, home page, occupation, phone number and languages preferred. Furthermore, users are able to choose a profile picture for themselves. Figure 15 illustrates the profile creating.

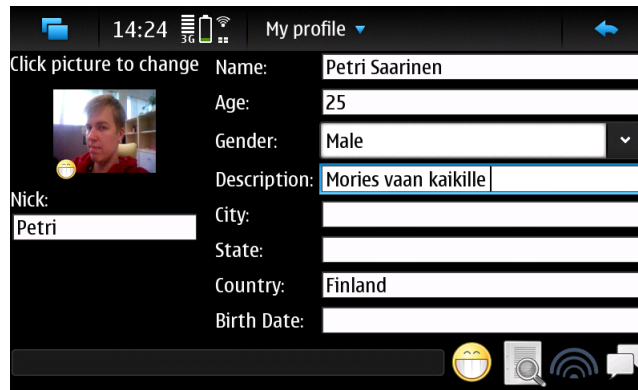


Figure 15: Profile creating

4.1.2. Network technology behind TWIN

One of the novel things behind TWIN is the network layer. Implementation is based on a peer-to-peer technology, which means that users are able to connect each other's mobile devices directly and no existing network infrastructure is needed. These independent peers are forming together the ad hoc network which functions, like mentioned, without any central servers. TWIN uses ad hoc WLAN technology for data transferring between the mobile devices, and therefore no cellular data transmission is needed during the use.

TWIN is able to use multi-hop transferring, thus connections over the WLAN range are possible by using other TWIN devices like routers. Figure 16 illustrates the multi-hop technology used in TWIN. User A and B are within the same range. In the same way, user B and C are connected. Multi-hop-transferring enables user A to communicate with user C via user B. In this way, the ad hoc networks can grow considerable wider. If user B disappears and is no longer within the range of user A, the connection to user C cuts off as well. Multi-hopping allows users to reach other users within larger range and creating wider communities.

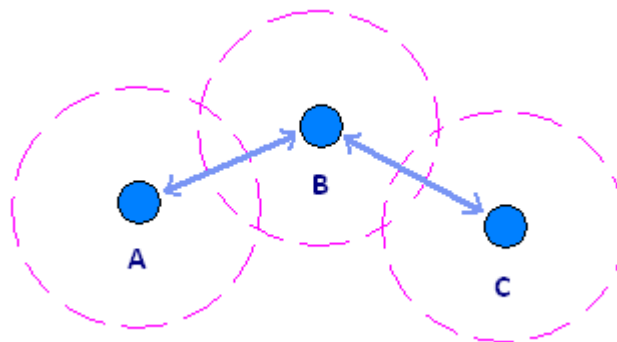


Figure 16: Illustrating multi-hop transferring

Multi-hop ad hoc networking in TWIN offers various possibilities, but contains some downsides as well. TWIN networks are highly dynamic, including continuously joining and leaving of users. This affects the reliability of the networks, especially to the message delivery and file transferring. Messages or files may not get across if users are moved beyond the range during the use situation. Even a sender and a receiver would stand in situ, the transfer may still cut off if a user between them moves outside of the network range.

As TWIN software was updated several times during the trial, there was a need for getting a reliable way for transferring the updates to the users' devices. In addition to ad hoc WLAN networking, TWIN uses public WLAN networks for fetching the software updates. Being at the TUT campus, the participants had access to the university WLAN network which is free of charge. In this way, developers ensured that as many participants as possible would get the updates in time.

4.2. TWIN pilot and participants

TWIN pilot, a nine-week long field trial was conducted between April and May in 2010. It was a large-scale trial which was carried out mainly by the Department of Computer Systems. In cooperation, the Unit of Human-Centered Technology (IHTE) conducted a user study during the trial. In addition to these parties, a student club called TEA-club attended to all practicality during the trial. The main purpose of TWIN pilot was to find out how the technology behind TWIN would function when there is large amount of users, how the users would use TWIN application and what they would think about it. Since TWIN is a totally new way to communicate and keep in touch with people in proximity, there were not much previous experiences with similar trials. Thus, the starting point for the trial and the user study was extremely interesting.

Before the beginning of TWIN pilot, information about the trial and participating was shared by advertisements, which were placed over TUT campus, and by messages, which were sent to various email lists and Internet forums. Due to range of ad hoc WLAN and the way of TWIN network forming, there was a need for a common place where users could be near each other. TUT campus was excellent for this purpose and therefore participation was limited to students and employees of TUT. People who would like to participate were requested to fill in a registration form in TWIN website. The registration form included questions about typical locations at campus, background information, and motivation for participation. In addition, people were asked to suggest TWIN pilot for their ten friends via the registration form.

It was quickly revealed that people were highly interested in participating in the trial, as 1051 applications were received within a week. From this amount, 250 students and

employees of TUT were chosen for TWIN pilot. Pajukanta (2010) describes in detail in his bachelor's work how the selection was done. All applicants were first categorized by their answers related to motivation question "*Why are you willing to participate in TWIN pilot?*". Maximum points were given if an applicant clearly appeared to be motivated and explained well why he would be a good choice. 65% of the applicants mentioned "Tietotalo" building as the location where they usually spend time at the campus. Organizers of TWIN pilot decided to focus the use of TWIN on this building, so participants were limited to people who were mentioned "Tietotalo" in their registration form. After these criteria, 30 most points earned applicants were selected as key participants and all their friends (who they suggested in the registration form) were invited to the trial as well. Finally, the rest of the participants were selected on the basis of total points, until there were 250 participants in overall.

After participants were selected, practical arrangements were started. For distributing required trial equipment to the participants, two meetings were organized. Every participant was borrowed N900 mobile phone with TWIN application pre-installed. In these meetings, participants also confirmed their participating in literarily and got the instructions how to update TWIN application during the trial. Since TWIN is functioning using ad hoc WLAN connections and public WLAN networks for getting the software updates, the use was free of charge and therefore participants were able to use their personal SIM-cards during the trial.

Participants used TWIN application during the nine-week long trial. The use was spontaneous and informal as there were no demands or scripted tasks for participants. As organizers wanted to ensure that the use was fluent and there were no problems related the application, two user meetings were hold during TWIN pilot. A startup meeting was arranged a week after the beginning and the latter when there were three weeks remaining of the trial. In both sessions, participants got instructions (if needed), were able to ask things related the trial and hear other participants' experiences. Furthermore, participants were able to get peer support from TWIN forum. It was an Internet forum, which was built for TWIN pilot and its users. Participants were welcome to share their experiences and ask about things exercised their minds during the trial.

TWIN forum was one way of giving the feedback in the trial. Furthermore, participants were able to tell about their experiences by answering several web questionnaires and 31 of them in interviews. The next section tells more about these and the user study. At the end of trial, N900 mobile phones were collected back. The ten most active participants got a phone as their own. This was a reward for giving valuable feedback to developers. From 250 participants, six left the trial unfinished. These participants were replaced with other applicants and therefore the user amount was the same through the trial.

4.3. User study process

The aim of the user study was to study the user experience of TWIN and investigate the experiences related to the usage of proximity-based technology. Based on this aim, three research questions were set (Table 1). There were also more concrete aims for TWIN application. These goals included the studying of the usage patterns and the use of various features of TWIN. Furthermore, the feedback of participants' concerns and new ideas were collected as developers were highly interested in these.

Table 1: The research questions of the user study

ID	Description
<i>RQ1</i>	<i>How do people use proximity-based technology for communication purposes?</i>
<i>RQ2</i>	<i>What kind of expectations people have towards such a technology?</i>
<i>RQ3</i>	<i>How do people experience the use of proximity-based technology?</i>

TWIN pilot was a great opportunity to study proximity-based social networking. The nine-week long trial with its 250 participants allowed studying user experience in a long term. For getting as extensive information as possible, several research methods were used for collecting user data. First, three web questionnaires were conducted during the trial. These were published at the beginning of the trial, two weeks after the beginning and at the end of the trial. In order to obtain both quantitative and qualitative data, a part of the participants were interviewed at the end of TWIN pilot. In addition to these main research methods, user data was collected from TWIN forum, TWIN feedback feature and user logs.

TWIN forum is an Internet forum which was built for the trial. The forum allowed users to share experiences of TWIN and get support from other participants and developers. A total of 1046 messages were posted by 75 participants during the trial. Further development of TWIN was one topic which especially gathered a lot of participants' experiences. The TWIN feedback feature was a simple feature in TWIN application which allowed participants to share the concerns of TWIN by sending short messages direct to developers. The feature functioned in one-way only, so the developers were not able to answer the messages. User logs were automatically collected by developers. This anonymous log information contained statistical user data about the usage of TWIN and its various features. The questionnaires and interviews are introduced more detail in following subsections.

The questions for web questionnaires and interviews were considered carefully. For reaching the main goals that were set, several topics for the questions were selected:

- *Participants' expectations of TWIN and meeting of them*
- *Participants' attitudes to social media*
- *Usage patterns and key features of TWIN*
- *TWIN's effect on participants' lives*
- *Privacy*
- *Ideas for further development*

Based on these topics, the questions of web questionnaires and interviews were composed. All these questions of questionnaires and interviews are listed in Appendixes. Participants were motivated to answer the questionnaires and be active users during the trial by giving ten N900 devices after the trial to the most active participants.

4.3.1. Heuristic evaluation

Before TWIN pilot started, TWIN application was reviewed with heuristic evaluation. Heuristic evaluation is one of the usability methods for evaluating a specific user interface. It is usually conducted in liaison with the user interface design process. The aim of the heuristic evaluation is finding possible usability problems which can be inconvenient for the end users. Heuristic evaluation is usually performed by a few usability experts who do the evaluation based on the predetermined heuristics. These heuristics are general usability principles of a kind and rules that define some common properties of well-designed and usable interfaces. (Nielsen 1994)

The heuristic evaluation for TWIN application was performed by a single researcher due to resources and strict time schedule. The heuristics list that was used for the evaluation contained rules and principles from Nielsen's Ten Usability Heuristics (Nielsen 1994) and Heuristics for supporting social interaction in online communities (Malinen 2009). For the evaluation, a test setup with three imaginary users was created. The views and the features of the application were gone through one by one and matched with the heuristics.

29 notices were obtained as a result. These notices were listed and categorized in four classes which were classified as critical (1), major (9), minor (13) issues and especially good solutions (6). Numbers in the brackets illustrate the amount of notices. Critical issues are problems which are required immediate fixing as they occur often and recovery is difficult. Major problems should be fixed though they do not completely prevent the use. Minor problems are usually cosmetic, but fixing them leads to more

pleasant user experience. Table 4 (Appendix A) lists the issues which were categorized as critical or major and were therefore significant for developers to know. This list in addition to other notices with improvement suggestions was sent to the developers of TWIN, in order to fix the issues before the beginning of the trial.

4.3.2. Questionnaires

The aim of the questionnaires was produce both qualitative and quantitative user data. A total of three web questionnaires were conducted during the trial. The questionnaires mostly consisted of multiply choice questions and scaled statements. In addition, a few open questions were included. Participants were announced published questionnaires in advance with an email message, which included a web link leading to the questionnaire. All questionnaires were open approximately one week since the publishing. The response rate of questionnaires was high; almost all participants (86%-100%) gave their answers to the questionnaires.

The first questionnaire was the startup questionnaire which was published at the beginning of TWIN pilot. All participants had to fill up this questionnaire in order to borrow the N900 device. The questionnaire was dealing questions about participants' background, their expectations about the trial and TWIN, and social media usage. The startup questionnaire sheet is included in Appendix B.

The first experience questionnaire followed the first one. This questionnaire included various questions about the first experience of TWIN, such as the usage of various features, the feasibility for communication purposes, TWIN's effect on social media and pros and cons of the application. The first experience questionnaire was published after two weeks from the beginning, as it was thought the participants had conveniently fresh experiences of the usage. 86% of the participants answered the questionnaire. The first experience questionnaire sheet is in Appendix C.

The final questionnaire was published at the end of TWIN pilot. At this point, participants had used TWIN application for approximately two months. The questionnaire was focused on the overall usage of TWIN, the use for communication purposes, privacy matters, overall satisfaction and ideas for further development of the application. The response rate of this questionnaire was 96%. The final questionnaire sheet can be found in Appendix D.

4.3.3. Interviews

For getting rich qualitative user data and shedding light into the reasons behind the quantitative results, structured interviews were conducted at the end of TWIN pilot.

Total of 31 participants, including one pilot interview, were interviewed. It was aimed to get a sample which would describe the whole group of participants in the most comprehensive way. For that reason, ten most active TWIN users, ten averagely active TWIN users and 11 active TWIN forum users were selected. In this way, it was able to hear experiences from participants who have used much TWIN and as well from the participants who have been less active for some reasons. Furthermore, active participants from TWIN forum were chosen as they seemed to have a lot of valuable information to share, especially new ideas and thoughts about the further development of the application. The chosen participants were interviewed one by one in interview situations which lasted approximately one hour each. The interview sheet is included in Appendix E.

4.3.4. Analysis methods

The analysis was based on both quantitative and qualitative user data. Quantitative data was gathered mostly from web questionnaires, but also data from user logs and interviews was included. In the web questionnaires, the quantitative analysis was based on the participants' answers of the scaled questions and statements. The mean scores and standard deviations were calculated from these results. The obtained results were summarized in various graphs and charts.

Qualitative data was gathered from interviews and TWIN forum. All interviews were taped. These recordings were listened to in the analysis phase and summarized to a written form. The notes which originally were made during the interview situations were taken into account as well. The qualitative data was used to clarify the results gathered from quantitative methods. This was done by searching for different the cause and effect relations between the quantitative and qualitative results.

4.4. Summary

The user study which was conducted during TWIN pilot aimed to study the user experience of TWIN application and the usage of proximity-based technology. TWIN pilot gave extensive possibilities for doing the research work. The nine-week lasted user trial with 250 participants allowed to study user experience in a long term. Several research questions and other more concrete research goals were set. Various research methods like web questionnaires and interviews were used for getting both quantitative and qualitative user data widely.

5. RESULTS

This chapter describes the results of TWIN user study. Results are categorized by themes which are presented in the sections below. Findings are summarized in the last section. Results are based on the participants' answers in the startup questionnaire, the first experience questionnaire, the final questionnaire and interviews. In addition, data was also collected from TWIN forum, user logs and TWIN feedback (a feature in the application).

These results have been partly published and presented in the conference of Mobile and Ubiquitous Multimedia 2010 (Väänänen-Vainio-Mattila et al. 2010).

5.1. Users' expectations

Users' expectations were one of the topics in the startup questionnaire. Expectations were asked with an open question. It was understandable that participants had not a very strong idea of what would be coming, since TWIN is a completely new way to communicate and keep in touch with people in proximity. However, participants still had some expectations of the trial and TWIN, and several reasons behind their participation.

Results were categorized by themes and sorted as Table 2 shows. The percentage in the left column indicates the participants who mentioned the expectation in the right column.

Table 2: Users' expectations (N=250)

Answers	Expectation (categorized)
25 %	I can keep in touch with friends
14 %	I hope I could get some new friends
14 %	This is interesting and I want to familiarize myself with TWIN
14 %	I want to influence on the development of the TWIN
12 %	<i>I have no expectations at all</i>
12 %	I want to try N900
11 %	I want to test the new technology

10 %	I can get a new view of social media's advantages
9 %	I want to familiarize myself with this new social way to keep in touch
8 %	I expect there would be some benefits for me
7 %	I'm interested to see will this system work in practice
6 %	I can learn something
6 %	I think TWIN is somehow better than other social medias (like Facebook or IRC)
5 %	I think this will be interesting project
4 %	I can get new experiences in using mobile community application

As it can be seen, most participants expected that TWIN would support communication with friends. 25% of the participants were eager to keep in touch with their existing friends and 14% hoped to get new friends with the help of TWIN. It seemed that participants considered TWIN as a tempting application and project, since 14% of them expected that TWIN would be interesting and the same amount was eager to contribute to the development of the application. 12% of the participants told they have no expectations at all. As earlier mentioned, this can be considered as understandable, since comparing such a novel technology with earlier experiences can be challenging.

The brand new technology aroused interest among the participants. 12% mentioned N900 as a one of the most expected things. Similarly 11% expected to be able to try out the new technology during TWIN pilot. Social media was also one of the mentioned topics. 10% of the participants expected that they could get a new view of social media's advantages. 9% were eager to familiarize themselves with a new social way to keep in touch. Less expected things included topics such as finding personal benefits, interest of seeing if the system works in practice, possibility to learn and finding something better if compared with the existing social media services.

Participants were asked to tell about their interest to communicate using a mobile device with others in proximity. Since TWIN can be used only with people nearby, it was significant to find out what kind of attitudes participants had towards such a system. "How interested are you in communicating with your friends nearby by using a mobile device?" and "How interested are you in communicating with unfamiliar people nearby by using a mobile device?" were the two closed question which were asked in the startup questionnaire. Both questions included a scale of 1 to 10 where 1 equated "not interested at all" and 10 equated "very interested". Participants gave an average value of 8.8 to the first question and 6.2 to the latter. Based on these results, participants were interested in both; communicating with existing friends and with unfamiliar people. However, participants were more into communicating with their existing friends.

5.2. Users' attitudes to social media

TWIN is strongly a social media application and therefore the participants' attitudes to social media were an interesting topic to study. The aim was to find out which kind of social media people use, how often, and what is their motivation behind the use. Several questions about the subject were asked the participants.

The startup questionnaire included the question "How often you use the following social media services?" with seven popular social media services listed. Figure 17 shows the list of the services and participants' use frequencies which based on the results. Participants' usage of social media services is based on their own answers as their use was not monitored in any way.

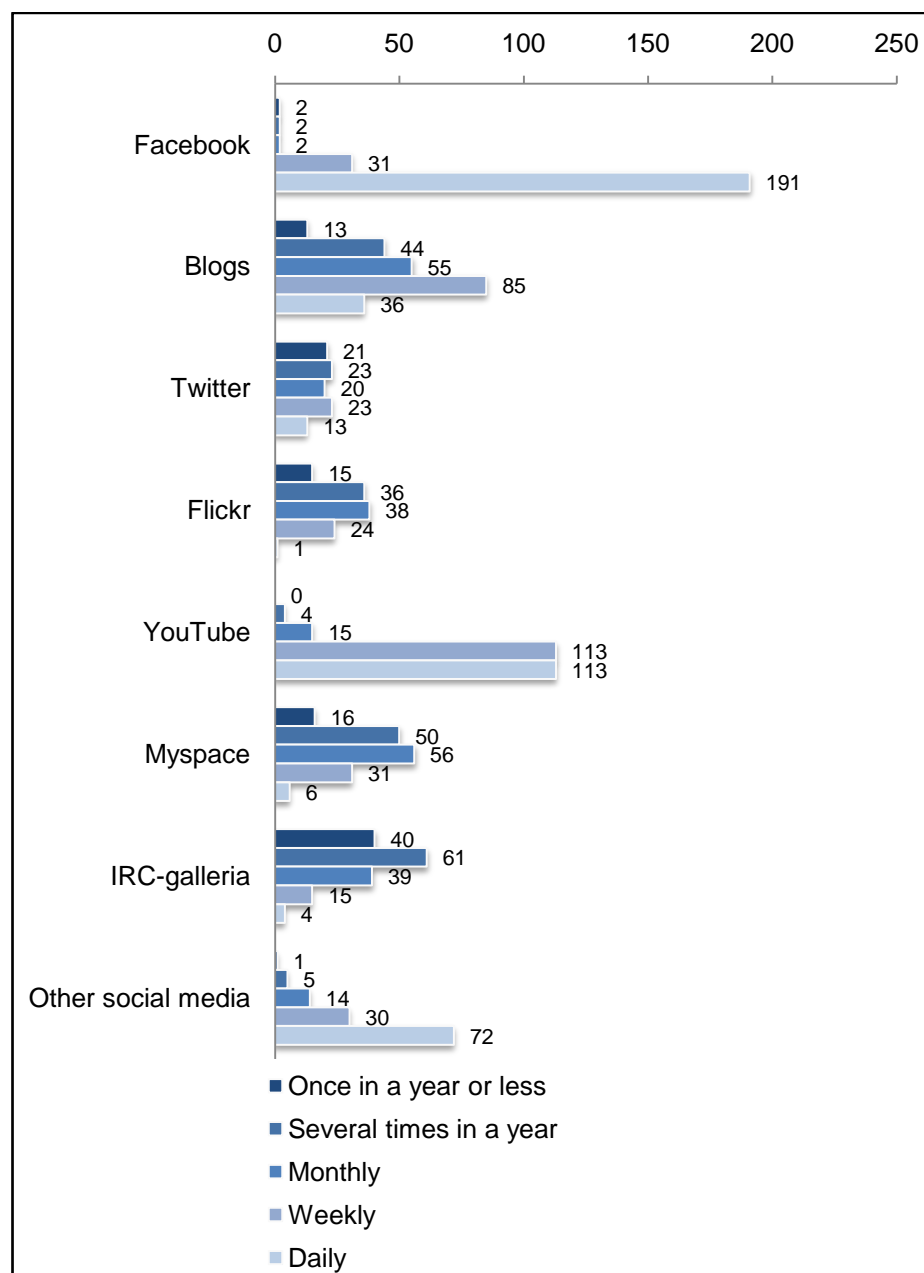


Figure 17: Use frequencies of participants' social media use (N=250)

In addition to these above mentioned services, the question about attitudes included an open space if a respondent wanted to add a service outside from the pre-given list. It appeared that the pre-given list of services was quite incomplete since participants mentioned over 40 different services from outside the list. None of these services were mentioned more than a couple of times, so at least the pre-given list seemed to gather the most common social media services.

As Figure 17 shows the most frequently used social media services were Facebook, YouTube and various blogs. When participants' were asked about the reasons for using social media, it came out that the most common reason was being able to keep in touch with friends. 93% of the participants mentioned this particular reason. The second most common reason (67%) was interest to follow other people's lives with the service. Sharing content (60%), possibility to discuss personal interests (56%), belonging to a community (46%) and meeting new people (33%) were some of the less mentioned reasons. Furthermore, few participants mentioned entertainment, playing, listening to music, searching information and searching a job as reasons for their social media use.

"[The reason for using social media is that] I can feel like being able to contribute to different things by sharing my opinions and web links via service. It is pleasing to show things to my friends and be heard that they liked these as well." (male, 24)

It appeared that the primary reason for using social media was the possibility to keep in touch with friends (76% mentioned as reason). This was also the most expected thing related to TWIN, as can be seen from the previous section. The second most important reason was interest to follow other people's lives with the service (12%). Surprisingly, no one mentioned meeting new people as primary reason though 33% mentioned it as a single reason. It seemed that being able to keep touch with friends is a must feature for social media and a possibility to meet new people is useful, but not a mandatory feature.

Participants' interest in adopting new social media services was also one topic which was studied. It was studied by a six degree closed question. The statements and the results of this question can be seen in Figure 18. The most significant finding was that even 21% of the participants often familiarize themselves with new services on their own and encourage their friends to familiarize with them. This statement was the highest degree in the question and 21% can be considered as fairly high amount though participants had a strong technology-oriented background.

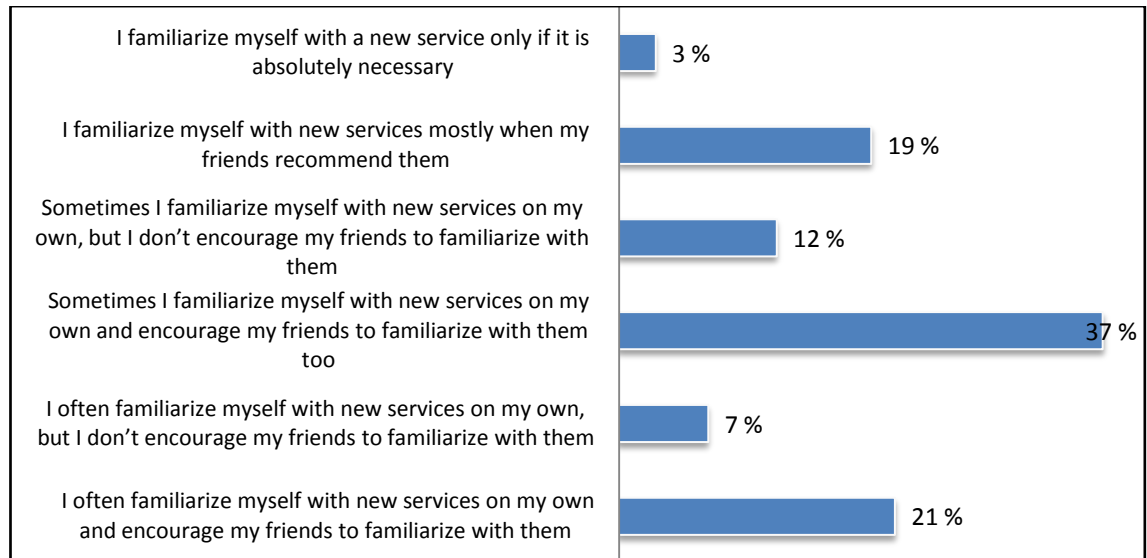


Figure 18: Adopting new social media (N=250)

5.3. Use of TWIN during the trial

According to the results, participants' use of TWIN reduced since the beginning of the trial. Half of the participants told they used TWIN at least on ten days during the first two weeks of TWIN pilot. During the last month, only six participants mentioned using TWIN at least on six days in a week. 78% used TWIN on 1-3 days in a week. The log data that was collected, confirms that the most active use occurred during the first two weeks of the trial (Figure 19). "Active users" in this graph means all the users who have used at least one feature of TWIN. "All users" counts in all users, whether the participant has used features, or just kept the application running in the background. Several constant falls in Figure 19 describe weekends. The use of TWIN was strongly focused on the campus of TUT and it mostly occurred during the weekdays, when students had lectures and employees were at their workplace.

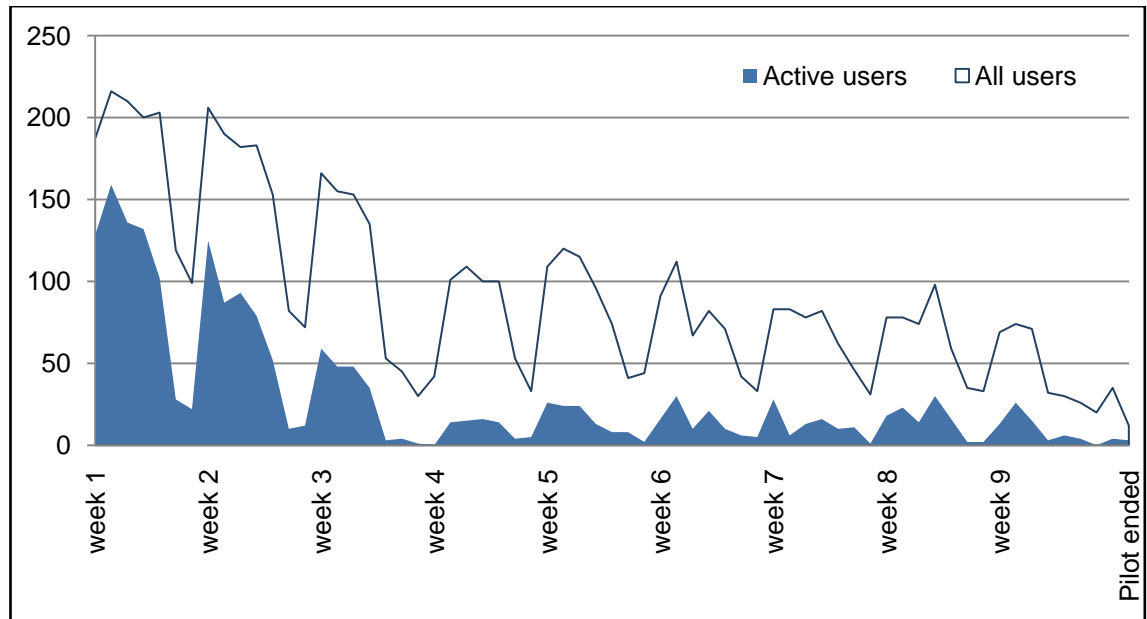


Figure 19: The usage of TWIN during the pilot (N=250)

Based on the feedback, the main reason for reduced use seemed to be technical problems that the participants met especially at the beginning of the trial. The fading first flush seemed to affect the use as well.

“The use [was] not so intuitive at the beginning of the trial. Uncertainty of getting a message across in the beginning [was] also one of the worst things in TWIN.” (male, 37)

The first two weeks of the trial

After two weeks of the use, the most used features of TWIN were private chat, community chat, and joining the communities. This supports participants’ expectations, as TWIN application was seen as a way to keep in touch with friends. File sharing and posting in message board were the least used features. It seemed that participants were slightly unaware how to use the message board and they seemed not to have a need for using it. File sharing was reported suffering from major technical problems which affected the user experience.

Participants were asked about the pros and cons that they had found when using TWIN application. When they were asked about the cons of TWIN, 28% of the participants mentioned that message sending and receiving were not reliable. It seemed that messages did not always reach the receiving user.

“It is not reliable software in any way at all. Messages are not getting across in every time. In addition, receiving a message doesn't bring any notification, unless you follow the chat, which makes people mobile phone staring nerds.” (male, 22)

Another significant con was the lack of notifications in the user interface, as 21% considered that TWIN did not notify clearly of the message that was received. Furthermore, it appeared that noticing of new messages was especially challenging when a mobile phone was in a pocket.

“I think that there is something missing about the notifications in Twin. If somebody writes something on the forum or sends us a message, we have to open the window to see it. I mean that we have got to stay in the window and to check it to see that somebody is trying to talk with us. That is not really handy. Maybe a light signal or even a sound could make it better.” (female, 22)

According to the results, the most satisfying pro of TWIN was the possibility to communicate with a friend nearby (21% of the participants mentioned this). 19% of the participants told that content sharing was another good feature, in spite of technical problems related to it. 14% mentioned that they particularly liked the idea behind of TWIN. Participants seemed to be very interested in using the location data of other users. 15% of the participants were satisfied as they could easily see all the other users who were nearby. In this way, TWIN seemed to increase participants’ awareness of their current location. Possibility to contact people nearby (12%) and usefulness of the radar feature (12%) were mentioned as well when asked about the good things of TWIN.

“You can easily see who are near you and [you] can effectively arrange meetings in a short period of time.” (male, 28)

In the end of the trial

Like earlier discussed, the usage of TWIN constantly reduced during the trial. At the end of the trial, only a few participants were as active as in the beginning. The use of different features was slight. Participants’ thoughts about the features of TWIN seemed to be the same than in the beginning without any considerable changes. File sharing was still the least used feature and chat-related features were the most used ones.

At the end of the trial, participants were asked about the best things in TWIN. Surprisingly, file sharing was mentioned the most often even participants did not use the feature much. It seemed that in this kind of application, it is crucial to have a possibility to share things, even if the use was not daily. The second most valued feature was radar. Participants appreciated the ability to know more about their surroundings and other users in proximity. Communication features and being able to contact people in proximity were the following features which participants considered as valuable.

The worst experiences related to TWIN were asked as well. According to the participants, one of the downsides in using TWIN was the battery consumption. It

seemed that the duration of the N900's battery was very limited for using TWIN application. TWIN uses WLAN connection, which is battery-consuming, for contacting to other devices which may explain this issue. Technical issues were the second thing which was mentioned. Especially technical problems in file sharing were affected negatively the user experience. Another thing which caused lots of dissatisfaction was the limited range of ad hoc WLAN. Participants would like clearly wider range when using the application.

The usage overall

Despite the slight use, there were active users enough to study the typical usage situations of TWIN application. As the trial was focused on the campus of TUT, the most usage situations located there. Community and private chatting and information sharing with other students during lectures, in corridors or campus cafes were frequent. Few use situations were located outside of the campus, as users chatted with their neighbors in student houses and some used TWIN application on busses to find out if their friends were nearby.

“TWIN proved to be a convenient way to communicate with neighbors, because I would not ring their doorbell without a very good reason.” (female, 19)

In the final questionnaire, participants were asked about their overall satisfaction in TWIN. According to the results, the use of TWIN was more fun and delightful than useful. The usage seemed to be more for entertainment and time passing than achieving certain predetermined goals.

5.4. Usage patterns of TWIN

Interviews included the question *“How can TWIN be used?”*. The purpose of the question was to find out different usage patterns, including the ones that participants do not have necessary tried during the trial but are willing to. The results were gathered and categorized. Total of six usage patterns were created based on the participants' thoughts. These categorized groups describe various use patterns and contexts that participants seem to think suitable for proximity-based communication technology.

Communication with existing friends

Results clearly indicate that participants were interested in using TWIN for communication with their existing social network. Also, this was one of the most expected things in TWIN. Participants found TWIN especially useful in situations where noticing a friend is challenging in otherwise, like in crowded places. Being more aware of friends in proximity makes the communication with them easier as well. Participants mentioned that TWIN could be used for making suggestion to friends

nearby, like asking for a coffee or lunch. It seems that TWIN suits well for this kind of quick and short discussion with friends.

Communication with unfamiliar people

Despite the fact that participants were more interested in using TWIN with their existing friends than contacting unfamiliar people, there was interest towards communicating with strangers in proximity. Participants were eager to use TWIN for getting more detailed information from unfamiliar people in nearby. Finding common interests among the other users seemed to be one thing which would help meeting them. Participants seemed to think that it is easier to meet a new person if you know that there is something common with you. In this way, TWIN could lower the threshold of meeting new people.

“It would help to find the people who have common interests, if these would be listed in the profile.” (male, 25)

Content sharing

During the trial, the use of file sharing was slight. However, participants seemed to think that the file sharing feature a proximity-based application is required. Though the use is not regular the feature is significant when needed. File sharing was seen useful in situations where a user has to send various files quickly to people around, for example in work meetings or in presentations. The streaming of files was seen also useful. Few participants suggested adding a feature which would enable live video streaming from the camera input to people in proximity.

“Video streaming straight from the camera (of the device) would be fun.” (male, 21)

Enabling communication in various contexts

TWIN was seen to enable communication in contexts where interaction would be challenging or impossible otherwise. Crowded places were one of the examples which participants gave. In a situation where lots of people are involved, it is challenging to find a certain person. Also, if TWIN would give detailed information about strangers, finding an interesting person in a crowded situation would be easier.

“I have met a few neighbors of my residential area [because of TWIN].” (female, 19)

One of the interviewed participants told about his experience in an ice-hockey match. He had found the use of TWIN delightful as the audience has included another TWIN user, with whom the participant has chatted during the match. Another example mentioned was lectures, where students are not allowed to talk each other, as it disturbs others. Participants found that TWIN allows chatting quietly in lectures. Users were

able to have conversations about the topic of the lecture and asking for a help from other students was easier as well.

Supporting collective co-operation

TWIN allows chatting with several people simultaneously. Community messages were perceived as useful in situations when a user has to communicate with a group in the same location, like in lectures or in happenings of a different kind. An example of an emergency situation was mentioned in the interviews. If a road cut off, TWIN would be useful for announcing in proximity.

Usage for marketing purposes

Participants had various ideas about how TWIN could be used for marketing purposes. They suggested that with the help of TWIN, customers would get more customized and a personal advertisement based on their interests. The users of the system would get advertisements when they are near the shop which is a part of the system as well.

“Shops would have specific TWIN-servers which would send advertisement to people nearby.” (male, 20)

5.5. Effect on the use of social media and other means of communication

One aim of the user study was to find out how the use of TWIN affects the use of other social media and means of communication that participants were using during TWIN pilot. This was studied in two phases, first in the first experience questionnaire and later in the final questionnaire. In this way, it was possible to study the evolvement of use. Participants were asked to answer two questions: *“How has the use of TWIN affected your usage of other social media?”* and *“How has the use of TWIN affected the ways you communicate with your friends or co-workers during a workday?”*.

Results of the first question clearly showed that TWIN did not affect the use of other social media. Participants’ point of view did not change during the trial. This may be due to the fact that TWIN is clearly a different system than the other social media services, and therefore it does not actually replace any other service but rather completes them.

It was found that TWIN slightly affected participants’ other means of communication, as some effect on daily communication was found (Figure 20 illustrates the results at the end of the trial). Participants’ use of IRC and SMS, face-to-face discussions and phone calls were slightly reduced. Furthermore, face-to-face discussion and the use of IRC were slightly increased. It seemed that TWIN gave a common subject for discussion.

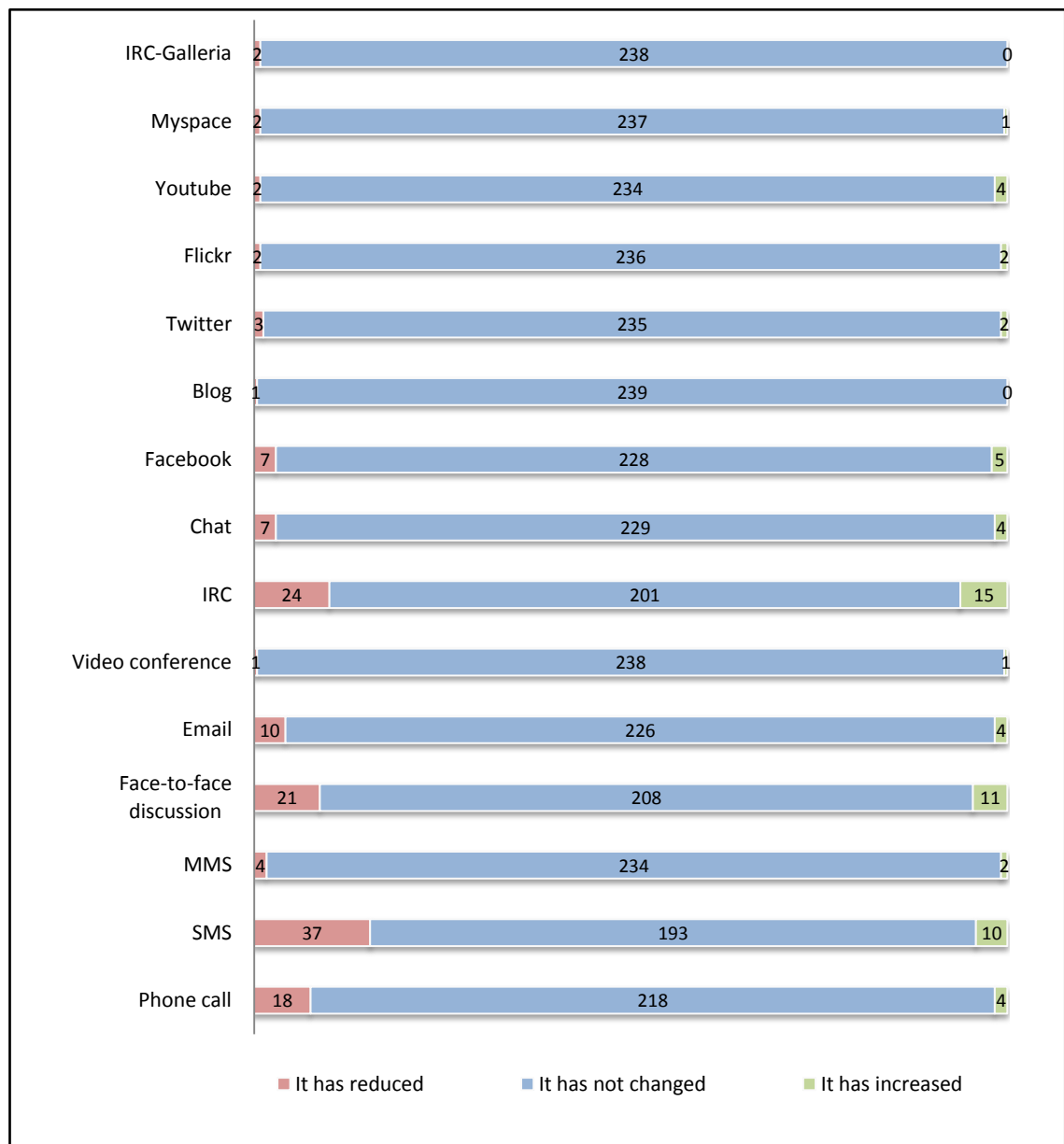


Figure 20: Effect on the other means of communication (N=240)

5.6. Effect on relationships

The use of social media is strongly connected with user's existing relationships. This topic was studied with several questions in interviews and final questionnaire. In interviews, participants were asked "How TWIN has affected your real life relationships?". Almost every interviewee told that TWIN has not affected their relationships. In the final questionnaire participants were given several statements (Figure 21 and Figure 22) related to the topic. They were instructed to choose the statement which would describe them best.

As Figure 21 shows, surprisingly even 22% of the participants had gotten at least one new friend with the help of TWIN. When taking into account technical problems occurred during the trial and relatively low usage, this can be considered as a fairly high number.

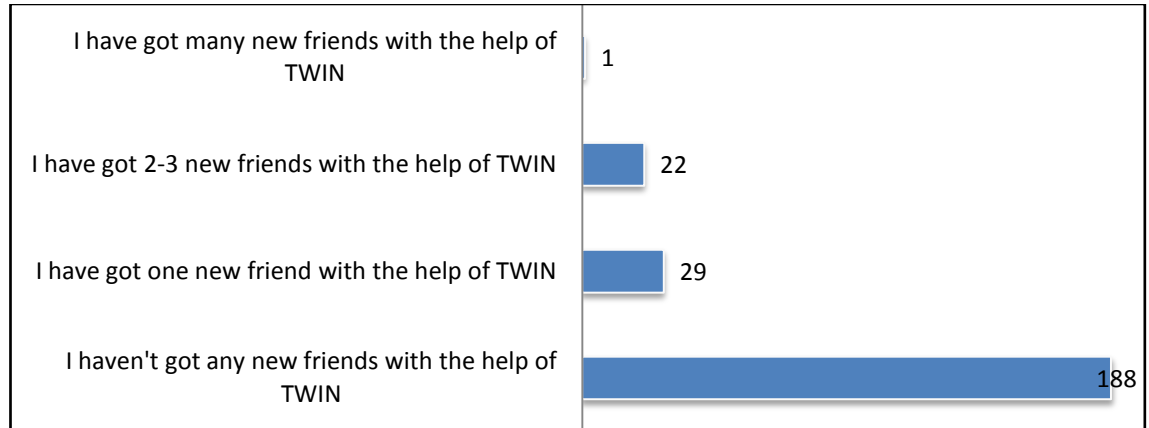


Figure 21: Getting new friends (N=240)

A word “*Friend*” can be understood in various ways. It can describe a person you daily see in the real life or a person who you spend time with online, for example chatting or playing multiplayer games. For this reason, it was necessary to ensure that all participants understood the term “friend” and the previous questions in the same way. Figure 22 describes the statements that were used in the final questionnaire for bringing clarity to this concern. As can be seen, results support the conclusion that participants actually got real friends with the help of TWIN whom they have met face-to-face.

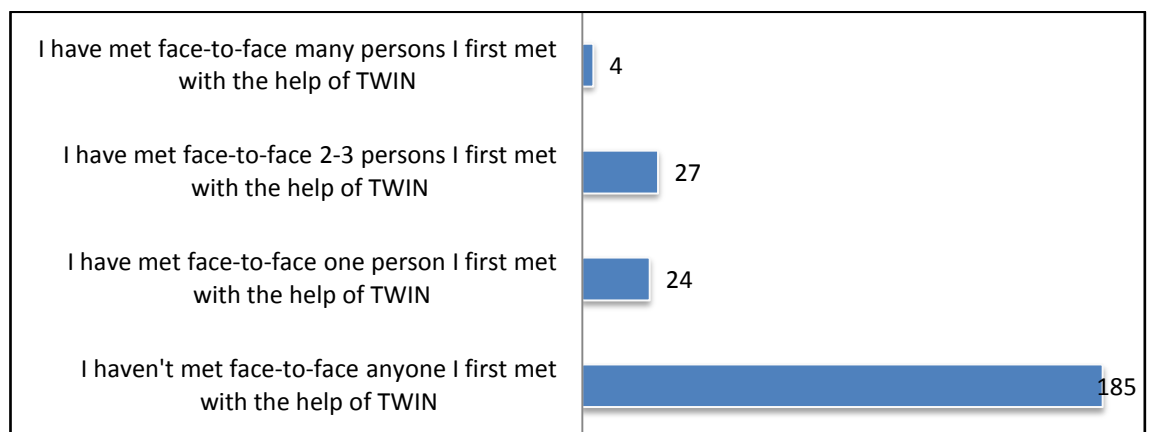


Figure 22: Meeting new friends in real life (N=240)

5.7. Privacy and Trust

Users are vital in social media services, as they are actually bringing the content to services. When personal content is shared, privacy is a significant matter to take into account. In this study, privacy was also one of the key topics that were studied. Privacy and trust related questions were included in the first experience questionnaire, the final questionnaire and interviews.

Current privacy

In the final questionnaire participants answered the question: *“Are you currently concerned about your privacy in TWIN?”* giving an average value of 2.9 (the scale was 1 to 10 where 1 was “not concerned at all” and 10 meant “very concerned”). Even 26% chose the lowest grade 1 which can be considered fairly high amount. In interviews, interviewees were asked how they had protected their privacy in TWIN. It appeared that almost every interviewee had taken privacy into account when filling details in the profile. Leaving phone number and street address rows blank seemed to be like a custom. It appeared that this was not limited to TWIN but participants were accustomed to do so in social media services as well.

“I haven't added my real name or anything else, this relates to that fact I don't add anything for example to Facebook either” (male, 26)

TWIN pilot itself seemed to affect the privacy matters. There were a few participants who thought that the privacy protection was not necessary since TWIN was a closed community. According to them, the closed trial was enough to ensure that other users are not whoever random people. Proximity baseness seemed to also have an influence on participants' thoughts about privacy. Some participants mentioned that in their opinion TWIN is not an open network as using it requires users to be in near proximity and distant people are not able to reach the network.

“...you have to be close to see [other users in TWIN], so it is not so public information [what you add in TWIN].” (male, 24)

TWIN allows users to chat anonymously. In certain situations, where only a few people are nearby, the preserving of anonymity can be challenging. It was asked if participants have experiences about such situations where their identity has been revealed against their will. Only three participants (1%) answered they had such experiences during the trial. None of these participants felt their issues as disturbing or harmful.

“I was downloading something just to see if the downloading works (it didn't) and after a few minutes I hear some user talking that somebody was trying to download this and this file from his N900.” (male, 23)

Improving the privacy

In interviews, participants were asked if they would like to improve privacy matters in TWIN. Despite the fact that participants were not currently concerned about their privacy, they had some ideas how they would feel more secure when using TWIN.

First of all, the participants were eager to be able to restrict the profile information that other users see. For example, some participants mentioned they would like to share their phone number with their friends only, not with all users. Specific friend and ignore lists for grouping other users were also required. Furthermore, participants wanted private communities, like invite-only or password-protected communities.

“It would be possible to create a private community to which anybody could not join but only by invitation. There could also be secret groups (similarly like in IRC) which would be visible only for the members.” (male, 24)

Trust

People rarely use the applications in which they don't trust. The reasons that have affected participants' trust to TWIN were considered as important to study. The interviewees were asked about the matters which have increased or decreased their trust to TWIN. The most common answer was that due to technical problems trust to TWIN has decreased. Especially problems in the beginning of the trial were often mentioned. Participants also told that uncertainty related to message sending (messages did not come across every time) decreased their trust.

“During the first versions (of TWIN) my trust flagged, because nothing really worked.”
(male, 26)

“Uncertainly. The messages don't get across. It is not suitable for important discussion.” (female, 19)

According to most participants the updates for TWIN application increased their trust. This is understandable since the technical problems were in a major role especially at the beginning of the trial. Other often mentioned reasons for increasing trust were cooperation with Nokia, TWIN forum and pleasant interaction with developers. It seemed that participants were satisfied the way developers reported about the developing process.

“Our suggestions are listened to. It is really important.” (male, 28)

5.8. Meeting the expectations

The first section of this chapter described the expectations that participant had at the beginning of TWIN pilot. At the end, participants were asked about how these expectations were met. The final questionnaire included 14 statements which were made based on the expected things. These statements were thematically categorized in six categories: “communication”, “technology”, “social media”, “usefulness”, “learning” and “TWIN pilot” (Table 3).

Table 3: Categorized statements

Communication	Q1	I have been able to keep in touch with my friends by using TWIN.
	Q2	TWIN has lowered the threshold to meet new people.
Technology	Q3	I have been able to try out new technology.
	Q4	I have gained experience of N900 device.
Social media	Q5	I have been able to familiarize myself with a new way to communicate.
	Q6	I have found a new point of view to taking advantage of social media.
	Q7	There is something in TWIN which is better than in other social media services.
Usefulness	Q8	TWIN has been useful to me.
	Q9	TWIN is a functioning service.
Learning	Q10	I have learned new things during the pilot.
	Q11	I have gained new experience of using the mobile community application.
TWIN pilot	Q12	I have been able to familiarize myself with the interesting service.
	Q13	I have been able to contribute to the development of TWIN.
	Q14	TWIN pilot has been interesting.

All statements were closed questions, including a scale 1 to 10 (1 meant “Completely disagree” and 10 meant “Completely agree”). Figure 23 illustrates participants’ answers to these statements.

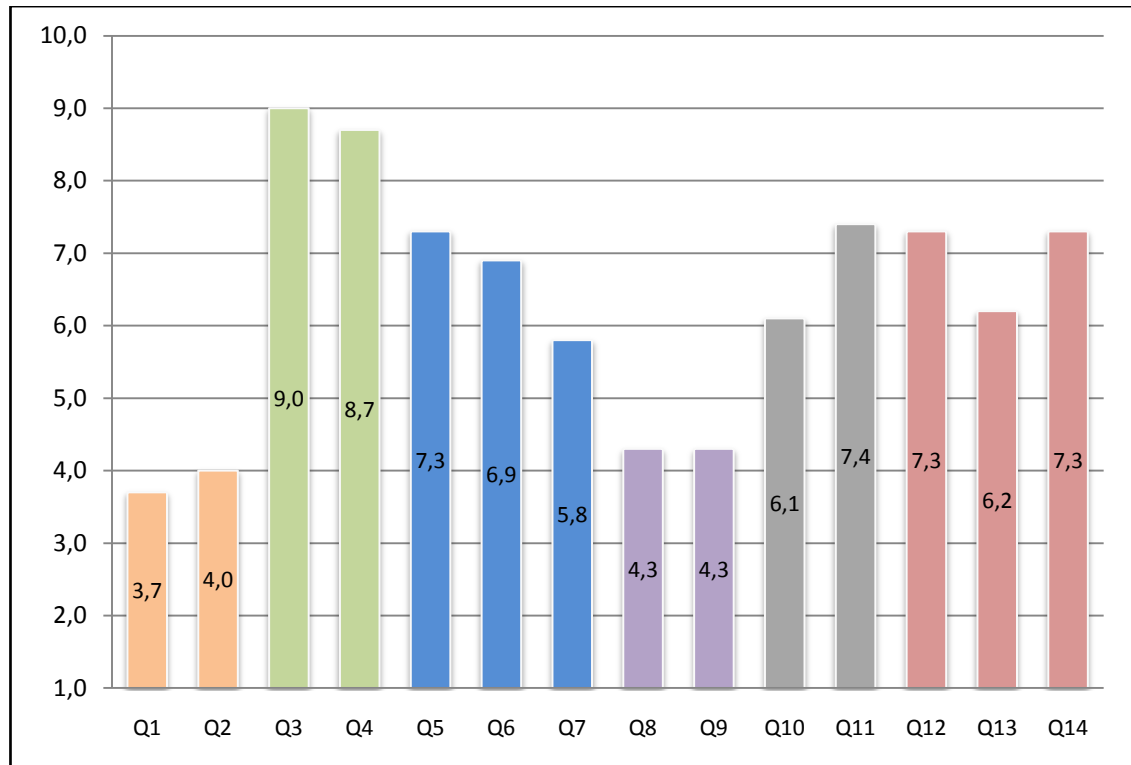


Figure 23: Meeting users' expectations (N=240)

As it can be seen, the grades that participants gave were over an average in most categories. Communication and usefulness were the two categories which participants were the least satisfied with. It seemed that participants were expecting more about communication with friends and unfamiliar people. One reason for lower grades might be the technical problems, especially these issues related to message delivery. Lack of reliability and uncertainty are things which affect user experience highly negatively. This theory is supported by the answers of participants, as few of them mentioned that sometimes they were not sure if the other user did not want to answer their message or was the silence instead due to technical issues of message delivery. Meeting new people in this kind of situation can be considered extremely challenging. Low grades related to usefulness are likely because of the technical problems as well. One of the most expected things was keeping in touch with friends. If the aim was not reached because of the technical issues, the application may not be considered as useful or functioning service.

The other extremity was the technology related statements. As results indicate, participants were extremely satisfied with being able to try the new technology and N900 device. It seemed that the proximity-based technology and N900 mobile phone were both something new and novel for most participants. Being able to satisfy the feeling of “I want to try something new” was clearly pleasing experience to participants. Participants also agreed they had learned things during TWIN pilot. The grade of 7.4 was given to the statement of “I have gained new experience of using the mobile community application”.

TWIN pilot itself was also one of the things which were appreciated by participants. Most agreed that they were able to familiarize themselves with the interesting service and trial. Also, being able to contribute of the development process was valued among the participants.

Social media related statements were agreed with grades over an average. Participants seemed to be the most satisfied with being able to familiarize themselves with a different way to communicate. This is a significant finding as one goal of the user study was to find out what participants would think about proximity-based technology and could they use it for communication purposes. It seemed that most participants had also found a new point of view to taking advantage of social media. Participants slightly agreed that TWIN contained something which other social media services do not have.

5.9. Further development

As it can be noticed from the participants' opinions, there is a need for making some changes to TWIN application. Actually, the development process already started during the trial, as developers of TWIN updated several times the application on the basis of feedback given. The development process continued after the trial, and therefore all opinions and feedback were very valuable. Participants were asked in the final questionnaire about the further development: "*Describe three, in your opinion, new ideas or innovative ways to use TWIN.*". Interviews included also the question "*If you were able to develop TWIN, what would you do?*". Results of these questions were categorized in the two following groups: "improvements to current features and user interface" and "new features requested".

Improvements to current features and user interface

Participants' suggestions for improving the current features included chat, communities, radar, file sharing and profile features. Results indicated that the chat feature would have been better if it had included smileys, timestamps in messages and possibility to invite more than one user to the private chat. Invite-only and private communities were requested relating to communities. The radar feature was one of the most interesting features according to participants and therefore various improvement ideas were related to it. More specific location data, like distance and direction, was requested.

"*Publish*" and "*send file*" terms caused some misunderstanding in the file sharing feature since they were too close to each other for meaning. The file sharing feature should have been more intuitive and contained more specific feedback, as users were unaware who other users had downloaded the file that they were sharing. Improvement ideas for profile included new "interests" field which would help a user to get detailed information about other users in proximity.

Participants gave a lot of feedback about the current user interface of TWIN. Problems in navigation were one thing which was mentioned. Navigation on menus was considered slightly difficult as user had to use several times “back” button for getting back to home screen. Also, some shortcuts were missing. Possibility to customize more the user interface was also requested, for example users were interested in changing the background picture and layout theme.

“I don’t like the current design of the user interface. It looks like some Lego-blocks on the black background.” (male, 23)

Participants were eager to have more feedback when using TWIN, for example a sound signal when receiving a message. Better integration to N900 was also one topic, and some participants thought TWIN should be a solid part of the Maemo platform. In this way, the use of TWIN would be easier, like using the call and SMS features.

New features requested

The list of new features which participants requested was almost endless. The most wanted things included features for gaming, dating and advertising. Many participants were interested in getting multiplayer games in the proximity-based application. Playing with others people in proximity seemed to help time spending and support meeting new people. Especially shy individuals could benefit from the multiplayer gaming if it made the interaction with other people easier. Dating was also mentioned strongly and meeting new people seemed to be one of the advantages of TWIN. Participants hoped that users could tag their interests in their profile so finding an interest user would not be so challenging. New feature functioning like Chatroulette (Braiker 2010) was also requested by a few participants.

Participants seemed to be interested in using TWIN for advertising as well. They suggested that shops could send customized advertisements to users who are in proximity of the shops. Location based information sharing could be also possible, as users could find detailed information about shops nearby easier with the help of TWIN. There seemed to be also a lot of interest in using TWIN for finding a specific hotel or restaurant. Some of the less mentioned ideas included adding a friend list to TWIN for making group controlling easier and Facebook-style “thumb up or down” feature for published files, which would function as a recommendation system.

5.10. Participants' thoughts about TWIN pilot

The most questions in the interviews and the web questionnaires were addressed the user experience of TWIN. There were also questions about the trial, since it was unusually large and therefore unique, and it may affect the user experience of TWIN. In the final questionnaire participants were asked about the satisfying and unsatisfying things in TWIN pilot.

The most satisfying thing in the trial was experiences of N900, as 41% of the participants mentioned it. Similarly, getting experiences of a new social application and a new way of communication caused satisfaction. Practical arrangements during the trial seemed to be also one of the things that participants were pleased with. Especially TWIN forum and the possibility to get support in many ways were mentioned as satisfying things.

“I was able to familiarize myself with N900 phone and test a new social media service.”
(female, 29)

It seemed that the participating in the development of TWIN was significant to participants. Participants felt the development was based on their feedback and therefore it caused satisfaction. Interaction between the developers of TWIN and participants can be described as close co-operation.

“It was nice to notice that software was developed all the time and on the basis of users' feedback. I had a feeling that participating in the project paid off!” (female, 20)

Technical problems were the most significant reason for dissatisfaction (21% gave this reason). 15% of the participants were unhappy to the battery duration of N900, as they had to charge it repeatedly. Some participants mentioned that in certain situations they were unable to keep the device with them, because they had no chance to charge it. The lack of active TWIN users (after the beginning of the trial) caused dissatisfaction which is understandable since TWIN is social media application and it needs users for creating the content and functioning.

As earlier mentioned, the pilot structure seemed to have at least a slight influence on the privacy matters. Some participants seemed to think that TWIN network was like a closed community, because the users were not whoever random people but TTY students and employees. This may have affected the participants' experiences and the results of this study could be different in other context.

In the final questionnaire participants estimated how satisfied they were in overall with participating in TWIN pilot. Participants gave the grade of 7.7 (the scale was 1 to 10,

where 1 means very unsatisfied and 10 is very satisfied), so even technical problems caused dissatisfaction, participants seemed to be pleased with participating in the trial.

5.11. Summary

At the beginning of TWIN pilot, participants had various expectations about TWIN and the trial. Most expected things related to communication with the help of TWIN. It appeared that participants were eager to use TWIN for keeping in touch with their existing social network, and for meeting new people. Some participants had no expectations at all, which can be considered understandable as TWIN is a totally new way to communicate in proximity using modern technology. Associating it with earlier experiences can be challenging.

Results indicated that participants were familiar with social media. Most frequently used social media services were Facebook, YouTube and various blogs. Furthermore, totally over 40 various social media services were mentioned being in active use. The most important reason for using social media seemed to be keeping in touch with friends. It was found out that TWIN did not affect participants' use of other social media during the trial. However, slight effect on the other means of communication was found: the use of SMS, IRC, phone calls and face to face discussions were reduced moderately. It seems that TWIN is closest to these means of communication though it does not fully replace any, but rather completes them.

It appeared that the use of TWIN is rather for entertainment and fun, than achieving practical goals. The lack of reliability caused by technical problems may have affected the pragmatic experience. Typical usage situations were placed in campus area. Chatting and information sharing with other users during lectures, in corridors or cafes were frequent. Discussion that occurred in TWIN network was usually short and quick.

File sharing, radar, private and community chats were the most appreciated features by participants. It was surprising that file sharing was named one of the best features of TWIN, since at the same time it was one of the least used features. Apparently file transferring and possibility to share content was valued highly in the proximity-based application though the use was not regular. Message board was another less used feature. It seems that participants did not find use for it in this kind of application.

The usage of TWIN reduced since the beginning of the trial. Slight use occurred still, but the most active use happened during the first two weeks. Based on the feedback, the most significant reason for reduced use were technical problems which participants met especially at the beginning. TWIN application was updated during the trial, but challenges in the beginning certainly negatively affected the user experience. Another

reason for decreased usage might be the fading of the first flush. This is natural human behavior, and it may happen when meeting something that seems to be a novel and interesting at the first sight.

There were no major concerns with privacy during the trial. Most participants felt they did not have to worry about their privacy at all. However, they had taken privacy into account when filling profile information: leaving rows of a phone number and a street address blank seemed to be more like a custom. Results indicated that experiences of privacy were affected by the trial itself. In participants' opinion, the use was more secure since TWIN pilot was a closed trial. Also, proximity baseness seemed to have slight effect on the experience of privacy. A few participants mentioned that TWIN is not an open network, since distant people are not able to reach the network.

Participants found both positive and negative things in TWIN. The most satisfying thing was to being able to communicate with friends in proximity. Also, using the application for getting more detailed information about other users and the possibility to share content, were considered valuable. The battery consumption of N900 device was one thing which caused dissatisfaction. Therefore, participants felt the device restricting their use of TWIN. Technical issues, like unreliability related to message delivery and file sharing were also mentioned. TWIN pilot itself provoked some thoughts, mostly positive ones. Participants seemed to be satisfied with the practical arrangements, like developers' support in TWIN forum and being able to contribute to the development process.

One of the most significant finding related to social relationships. In spite of technical issues and relatively slight use of TWIN, even 22% of the participants had got at least one new friend by TWIN. The trial where participants are together may have affected this; at least some participants told TWIN pilot had given a common subject for discussions. Still, it is obvious that the proximity-based technology is a potential way of meeting new people in proximity.

Participants had various new ideas about further development of TWIN. Games and dating applications were the most common ideas that were suggested. These and many other ideas were related to communication in proximity, especially supporting to meeting new people. This kind of concept which encourages the interaction between familiar and unfamiliar people was considered clearly as valuable. Overall, the feedback of TWIN was positive and encouraging. The results clearly indicated that there is interest towards proximity-based communication.

6. CONCLUSIONS

This chapter summarizes the thesis discussing the research questions that were set and highlighting the most significant matters in the user study. The results are discussed and compared with the literature. Furthermore, the further development and future work is discussed.

6.1. Summary of the thesis

This thesis described the user study of the trial called TWIN pilot and its results. The main aim of the study was to find out how people use proximity-based technology for communication purposes. Also, expectations related the novel technology and meeting them were studied. 250 participants participated in TWIN pilot and used TWIN application approximately during two months. This setup offered a great opportunity to study in-depth user experience of proximity-based communication. For achieving the aims, that were set, various research methods were used. Three web questionnaires were conducted at the beginning, after the first experience and at the end of the trial. Deeper qualitative data was gathered with personal interviews at the end of TWIN pilot. User logs, a web forum and a specific “send feedback” feature of the application were used for collecting user data as well.

Before the study, three research questions were set. Based on the results, these questions are now talked through.

RQ1: How do people use proximity-based technology for communication purposes?

The results indicated that participants in TWIN pilot were eager to use proximity-based technology for communicating with their friends. Also, using technology for meeting unfamiliar people was considered interesting, but not as strongly. However, it appeared that TWIN supported highly meeting unacquainted people. The effect on participants’ social relationships was remarkable as many participants got new friends during the use of TWIN. Overall, the usage was more to entertainment and fun, than achieving practical goals. Discussions in TWIN networks were usually short and rapid. Multi-player gaming and dating application were suggested to the application. Both features were seen to support the evolution of interpersonal relationships in a significant way.

RQ2: What kind of expectations people have towards such a technology?

Participants had various expectations before the trial. Most expectations were related to communication possibilities. It appeared that the most expected subject was being able to keep in touch with the existing social network. This associated with social media, as the results show that the most important reason for using social media is possibility to keep in touch with friends. Also, meeting unfamiliar people was expected, but not so significantly. Overall, the proximity-based technology was seen interesting and part of the people expressed strongly that they wanted to familiarize themselves with it.

RQ3: How do people experience the use of proximity-based technology?

TWIN met participants' expectations partially. Technical issues that occurred during the use negatively affected the user experience, which showed clearly in the meeting of the expectations. The communication possibilities and overall usefulness of the application were the two subjects that the participants were least satisfied with. The dissatisfaction seemed to mostly cause by the lack of reliability and uncertainty in message delivery. Participants were extremely satisfied with being able to try new technology. Being able to familiarize oneself with a different way to communicate in proximity was appreciated. It was slightly agreed that TWIN included something which other social media do not.

6.2. Discussion

Nowadays, the mobile devices that people are carrying in their pockets enable different kind of communication. Technologies like IR, Bluetooth and WLAN are allowing people to keep in touch with their friends and meeting unfamiliar people in proximity. New usage patterns and use contexts have been developed due to possibilities that proximity-based technology has offered.

Liu et al. (2010) divide mobile social network sites into three categories based on the usage purposes of the services. These categories are dating, content producing and doing business. Based on the results of the user study, TWIN cannot be put into a single category, as all of these aspects came up in the results of TWIN user study. Dating was one of the most significant subjects for further development of TWIN. Content producing was not mentioned highly, but the lack of it was noticed. One of the requirements for functioning service in this kind of technology seems to be achieving the critical mass of users and enabling them to share content. The business related theme was seen rather from the user's perspective than a business provider. Participants were eager to get customized advertisements when passing the shops.

Holmquist et al. (1999) introduced Hummingbird device which gives visual and auditory signals when a specific person comes in proximity. They found that the device increases awareness between the users and complements other means of communication such as calling and emailing. Also, Persson et al. (2005) present similar findings in the use of DigiDress application. According to them, DigiDress aimed to complement existing interaction practices, not replacing them. The results of TWIN user study support these findings. TWIN did either not replace any means of communication, but rather complements them. Though, the use of IRC and SMS, face-to-face discussion and phone calls were reduced, but only slightly. Similarly than Hummingbird, TWIN increased awareness of the context by the radar feature.

As earlier mentioned, various conversations occurred in TWIN network, but the nature of discussion was rapid and short. Holmquist et al. (1999) argue that IPADs are mostly used for helping the initiation of the communication, but not for maintaining the actual interaction. This is supported also by the case study of Dodgeball (Humphreys 2008). They found that Dodgeball helped users to coordinate face-to-face meetings among the friends. It seems that this kind of technology is especially suitable for improving the awareness of other users and helping users to meet each other, but the actual interaction is rather done otherwise.

The research methods in TWIN pilot included before-, during- and after the use methods. As Isomursu (2008) emphasized, user experience evaluation needs methods that allow collecting relevant information just at the time when the experience is formed. Before the trial, participants were surveyed about their attitudes and expectations. During the use, the first experience questionnaire was conducted, and with it and the final questionnaire, it was possible to study the evolvement of the use as well. Measuring the user experience in several times increased the reliability as well. The reliability of the study was ensured also by using various data collection methods.

Isomursu et al. (2007) mentioned that the user experience evaluation should be integrated into users' everyday practices so participants' focus stays on the technology which is studied. In TWIN pilot, it was found the trial bound participants together. TWIN was a common subject in discussions during the pilot. Participants also mentioned that they felt more secure, as they know that other users were fellow students or employees of TUT. These matters may have affected the validity of the study. In different context, the results may have varied.

6.3. Future work

The results indicated that people are interested in using proximity-based technology for communication purposes. The proximity-based technology was seen especially valuable for communication with the existing social network. The peer-to-peer technology enables the establishing of stand-alone ad hoc networks without a need for existing infrastructure. This allows communication in places and situations where it would be challenging or impossible otherwise. The technology still includes some challenges. The lack of reliability in message delivery caused dissatisfaction in TWIN pilot. Providing trustworthy messaging in the situations where users are able to move continuously and change their location is a challenge to be solved.

TWIN pilot was conducted in a campus context. In future, the usage of proximity-based technology would be interesting to study in various contexts, like shopping centers or in the events where a lot of people is involved. However, it is significant to remember that social media services are bound to the critical mass, thus a decent number of users is needed no matter what the context is.

Various ideas for further development came up. These included mostly features that would support meeting unfamiliar people, like dating and multi-player gaming possibilities. Apparently, the proximity-based technology was seen to support very well dating and meeting strangers, as it combines the easiness of finding common interests and the initiation of face-to-face discussions. As the overall feedback was positive and encouraging, the further development of proximity-based applications can be seen significant and relevant.

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APPENDIX A RESULTS OF HEURISTIC EVALUATION

Table 4: Critical and serious issues found

ID, category	Description	Improvement suggestion
1, critical	When the send file feature is used, the application returns as many file transfer dialogs as there are receivers.	When the send file feature is used for sending to several users, file transfer dialogs are not shown. The information about data transfer could still be shown in the events view.
2, major	There is no shortcut for going back to the home view.	A shortcut button should be added.
3, major	Names in the active chats are not updated even the names are changed.	If the user changes his nick, the information should be updated in the name list.
4, major	Bug related timestamps and message history; after chatting with another user if you close the application and then reopen it, the earlier chat messages are shown as a new chat conversation with wrong timestamps.	Timestamps should be correct in every situation.
5, major	User groups are not supported.	Adding at least basic user groups; friends and ignored users. This would allow users to control more about the information shared.
6, major	Another user's profile contains a shortcut to message board view, which is irrelevant.	Removing the shortcut if there is no point for it.
7, major	More actions tab includes remove from community and refetch features. Remove button is not working and the idea for refetch is unclear.	Removing the whole tab. Moving invite to community and announce when user appears features to profile tab.
8, major	Automatic refresh is not available in message board view.	Automatic refresh should be added so if a user opens the message board, the list is refreshed automatically.

9, major	There are not any restrictions for changing the picture or description of a community.	The original creator of a community should only have the right to modify the properties of the community.
10, major	Description of a community should be more visible. The description is shown only when joining in a community or changing the description.	The description should be visible when user is in a community view.

APPENDIX B TWIN STARTUP QUESTIONNAIRE

1) What is your training programme? If you are not a student, please select “I’m not a student”

- I’m not a student
- Architecture
- Automation Engineering
- Biotechnology
- Mechanical Engineering
- Materials Engineering
- Civil Engineering
- Signal Processing and Communications Engineering
- Electrical Engineering
- Science and Engineering
- Information and Knowledge Management
- Information Technology
- Industrial Engineering and Management
- Environmental and Energy Technology

2) Which department are you working for? If you are not an employee, please select “I’m not an employee”

- I’m not an employee
- Architecture
- Biomedical Engineering
- Electronics
- Energy and Process Engineering
- Physics
- Intelligent Hydraulics and Automation
- Chemistry and Bioengineering
- Language Centre
- Mechanics and Design
- Mathematics
- Materials Science
- Software Systems

- Optoelectronics Research Centre
- Civil Engineering
- Signal Processing
- Automation Science and Engineering
- Electrical Energy Engineering
- Industrial Management
- Business Information Management and Logistics
- Computer Systems
- Communications Engineering
- Production Engineering

3) How often you use the following social media services?

Options: never, once in a year or less, several times in a year, monthly, weekly, daily

- Facebook
- various blogs
- Twitter
- Flickr
- YouTube
- MySpace
- IRC-Galleria
- Other, what?

4) Why do you use the above-mentioned services?

- I'm keeping in touch with my friends
- I want to meet new people
- I can discuss my interests
- I like to belong to a community
- I think it's interesting to follow other people's lives with the service
- I want to share content with the help of the service
- Other reason, what?

5) Which of these reasons is the most important reason for you to use these social media services?

- I'm keeping in touch with my friends

- I want to meet new people
- I can discuss my interests
- I like to belong to a community
- I think it's interesting to follow other people's lives with the service
- I want to share content with the help of the service
- Other reason, what?

6) How do you usually keep in touch with your friends or co-workers during a workday?

- Phone call
- Short Message Service (SMS)
- Multimedia Messaging Service (MMS)
- Face-to-face discussions
- Email
- Videoconference
- IRC
- Chat
- Facebook
- Blog
- Twitter
- Flickr
- YouTube
- MySpace
- IRC-Galleria
- Some other way, what?

7) Which of the following describes you best in adopting social media?

- I often familiarize myself with new services on my own and encourage my friends to familiarize with them too
- I often familiarize myself with new services on my own, but I don't encourage my friends to familiarize with them
- Sometimes I familiarize myself with new services on my own and encourage my friends to familiarize with them too
- Sometimes I familiarize myself with new services on my own, but I don't encourage my friends to familiarize with them

- I familiarize myself with new services mostly when my friends recommend them
- I familiarize myself with a new service only if it is absolutely necessary

8) Which of the following describes best your opinion on social media?

- I think using social media is delightful, but it is not of real use for me
- Using social media is mostly delightful, but I find it is of some use for me too
- For the most part I find social media useful for doing some things, but using it is slightly delightful too
- For me social media is only a tool for doing some things. Otherwise I don't find using social media is delightful

9) What do you expect of TWIN-pilot? (open)

10) How interested are you in communicating with your friends nearby by using a mobile device? (scale 1 to 10)

1 = not interested at all

10 = very interested

11) How interested are you in communicating with unfamiliar people nearby by using a mobile device? (scale 1 to 10)

1 = not interested at all

10 = very interested

APPENDIX C TWIN FIRST EXPERIENCE QUESTIONNAIRE

1) How often you have used TWIN?

- I haven't used at all
- on a day
- on 2-3 days
- on 4-6 days
- on 7-10 days
- more than on ten days

2) How often you have done the following things in TWIN?

Options: not even once, once, 2-4 times, 5-10 times, over 10 times

- Sending a private message to friend
- Sending a private message to unfamiliar person
- Discussing in a group with friends
- Discussing in a group with unfamiliar persons
- Sending a file to friend
- Sending a file to unfamiliar person
- Reading the message board
- Adding a message to the message board
- Creating a community
- Joining a community

3) In your opinion, how well does TWIN suit for communication with friends nearby?
(scale 1 to 10)

1 = Doesn't suit at all

10 = Suits very well

4) In your opinion, how well does TWIN suit for communication with unfamiliar persons nearby? (scale 1 to 10)

1 = Doesn't suit at all

10 = Suits very well

5) How the use of TWIN has affected your other social media use?

Options: I have used considerable less, I have used slightly less, It hasn't affected, I have used slightly more, I have used considerable more

- Facebook
- Various blogs
- Twitter
- Flickr
- YouTube
- MySpace
- IRC-Galleria
- Other, what?

6) How has the use of TWIN affected the ways you communicate with your friends or co-workers during a workday?

Options: It has reduced considerably, It has reduced slightly, It hasn't affected, It has increased slightly, It has increased considerably

- Phone call
- Short Message Service (SMS)
- Multimedia Messaging Service (MMS)
- Face-to-face discussion
- Email
- Videoconference
- IRC
- Chat
- Facebook
- Blog
- Twitter
- Flickr
- YouTube
- MySpace
- IRC-Galleria
- Other, what?

7) Does it show clearly in TWIN who others are using the service at the same time?
(scale 1 to 10)

1 = It doesn't show clearly at all

10 = It shows clearly

8) Are you concerned about your privacy in TWIN? (scale 1 to 10)

1 = I'm not concerned at all

10 = I'm very concerned

9) How well TWIN suits exactly you? (scale 1 to 10)

1 = Doesn't suit at all

10 = Suits very well

10) What pros there are in TWIN? (open)

11) What cons there are in TWIN? (open)

12) How enthusiastic are you in using TWIN at the moment? (scale 1 to 10)

1 = I'm not interested at all

10 = I'm very interested

13) 22.3.2010 was arranged the TWIN pilot startup meeting. Do you think the meeting was useful?

- I didn't attend the meeting
- I think the meeting was not useful
- I think the meeting was slightly useful
- I think the meeting was very useful

APPENDIX D TWIN FINAL QUESTIONNAIRE

1) How often you have used TWIN within last month?

- not at all
- on 1-3 days
- once a week
- on 2-3 days a week
- on 4-5 days a week
- at least on 6 days a week

2) How often you have done the following things in TWIN within last month?

Options: not at all, on 1-3 days, once a week, on 2-3 days a week, on 4-5 days a week, at least on 6 days a week

- Sending a private message to a friend
- Sending a private message to an unfamiliar person
- Discussing in a community with friends
- Discussing in a community with unfamiliar persons
- Sending a file to a friend
- Sending a file to an unfamiliar person
- Reading the message board
- Adding a message to the message board
- Creating a community
- Joining a community

3) How has the use of TWIN affected your usage of other social media within last month?

Options:

I have used other social media considerably less than before the pilot

I have used other social media slightly less than before the pilot

It hasn't affected my usage of other social media

I have used other social media slightly more than before the pilot

I have used other social media considerably more than before the pilot

- Facebook
- Various blogs
- Twitter
- Flickr
- YouTube
- MySpace
- IRC-Galleria
- Other, what?

4) Within last month, how has the use of TWIN affected the ways you communicate with your friends or co-workers during a workday?

Options: It has reduced considerably, It has reduced slightly, It hasn't affected, It has increased slightly, It has increased considerably

- Phone call
- Short Message Service (SMS)
- Multimedia Messaging Service (MMS)
- Face-to-face discussion
- Email
- Video conference
- IRC
- Chat
- Facebook
- Blog
- Twitter
- Flickr
- You Tube
- MySpace
- IRC-Galleria
- Other, what?

5) In your opinion, how well does TWIN suit to communication with friends nearby (based on your current experiences)? (scale 1 to 10)

1 = Doesn't suit at all

10 = Suits very well

6) In your opinion, how well does TWIN suit to communication with unfamiliar persons nearby (based on your current experiences)? (scale 1 to 10)

1 = Doesn't suit at all

10 = Suits very well

7) Which of the following statements describes you best?

- I haven't got any new friends with the help of TWIN
- I have got one new friend with the help of TWIN
- I have got 2-3 new friends with the help of TWIN
- I have got many new friends with the help of TWIN

8) Which of the following statements describes you best?

- I haven't met face-to-face anyone I first met with the help of TWIN
- I have met face-to-face one person I first met with the help of TWIN

- I have met face-to-face 2-3 persons I first met with the help of TWIN
- I have met face-to-face many persons I first met with the help of TWIN

9) How do you experience the fact that you can communicate with TWIN to persons nearby only? (scale 1 to 10)

1 = I experience it as very harmful

10 = I experience it as very useful

10) What do you think about the following statements? (scale 1 to 10)

1 = Completely disagree

10 = Completely agree

I have been able to keep in touch with my friends with the help of TWIN

TWIN has lowered the threshold to meet new people

I have been able to familiarize myself with an interesting service

I have been able to contribute to the development of TWIN

I have gained experience of N900 device

I have been able to try out new technology

I have found a new point of view to taking advantage of social media

I have been able to familiarize myself with a new social way to communicate

TWIN has been useful to me

TWIN is a working service

I have learned new things during the pilot

There is some feature in TWIN that is better than in other social media services in my opinion

TWIN pilot has been interesting

I have gained new experience of using a mobile community application

11) How delightful is it to use TWIN? (scale 1 to 10)

1 = Not delightful at all

10 = Very delightful

12) How fun is it to use TWIN? (scale 1 to 10)

1 = Not fun at all

10 = Very fun

13) How useful is TWIN to you? (scale 1 to 10)

1 = Not useful at all

10 = Very useful

14) Does it show clearly in TWIN who are others using the service at the same time? (scale 1 to 10)

1 = It doesn't show clearly at all

10 = It shows very clearly

15) Are you currently concerned about your privacy in TWIN? (scale 1 to 10)

1 = I'm not concerned at all

10 = I'm very concerned

16) Have you been in a situation during the pilot where your identity has been revealed against your will?

- Yes
- No

If you answered yes, please tell what kind of situation it was and how did you react?
(open)

17) What are the three best things about TWIN? (open)

18) What are the three worst things about TWIN? (Especially things related to the concept of the service) (open)

19) Describe three, in your opinion, new ideas or innovative ways to use TWIN (you can pick these up from your earlier feedback or give new ideas). (open)

20) What do you think about the following statements? (scale 1 to 10)

1 = Completely disagree

10 = Completely agree

In my opinion, TWIN is very attractive.

In my opinion, TWIN is completely reliable.

I use TWIN mainly as entertainment.

I use TWIN mainly to achieve certain predetermined goals.

TWIN offers me interesting content.

TWIN supports the image I want to communicate to others about myself.

TWIN brings me closer to my friends.

21) Did you wish for more instructions when you started to use TWIN?

- Yes
- No

If you answered yes, what kind of instructions did you wish for? (open)

22) How enthusiastic are you in using TWIN at the moment? (scale 1 to 10)

1 = I'm not enthusiastic at all

10 = I'm very enthusiastic

23) Would you like to use TWIN after the pilot has ended? (Your answer will not affect your chances of winning the N900 to yourself.) (scale 1 to 10)

1 = Not at all

10 = I would like to very much

24) Would you recommend TWIN to others? (scale 1 to 10)

1 = No way

10 = Absolutely

25) Are you satisfied with participating in the pilot? (scale 1 to 10)

1 = Very unsatisfied

10 = Very satisfied

26) Which things made you especially satisfied in the pilot? (open)

27) Which things made you unsatisfied in the pilot? (open)

28) If you would like to add something, please write it here. Thank you. (open)

APPENDIX E TWIN INTERVIEWS

(Questions are translated from Finnish)

1) How have you been using TWIN?

(Miten TWINin kanssa on mennyt?)

2) How has TWIN met your expectations?

(Miten TWIN on vastannut odotuksiisi?)

3) What benefits has TWIN offered you?

(Mitä hyötyä TWIN:stä on ollut sinulle?)

4) What disadvantages has TWIN caused?

(Mitä haittaa TWIN:stä on ollut sinulle?)

5) How can TWIN be used, in your opinion?

(Mihin TWINiä voi mielestäsi käyttää?)

6) Whom does TWIN suit to, in your opinion?

(Kenelle TWIN mielestäsi sopii?)

7) For what kind of things have you used TWIN most?

(Minkälaisiin asioihin olet itse käyttänyt TWIN:iä eniten?)

8) What makes you to use TWIN for these particular things?

(Mikä saa sinut käyttämään TWIN:iä juuri näihin asioihin?)

9) The file sharing feature has been used only slightly. Do you have thoughts about why is it so? (Tiedostonjakotoimintoa on käytetty vain vähän. Mistä arvelet sen johtuvan?)

10) Have you used TWIN for the same things during the last two weeks than in the beginning of the pilot? (Oletko käyttänyt TWIN:iä viimeisen kahden viikon aikana samoihin asioihin kun pilotin alussa?)

11) How does it affect you that TWIN can be used only for communication with people nearby? How does it restrict? What does it make possible?

(Millä tavalla sinuun vaikuttaa se, että TWIN:llä voi kommunikoida vain lähistöllä olevien henkilöiden kanssa? Miten se rajoittaa? Mitä se mahdollistaa?)

12) What benefits does it give to you that TWIN allows to see the location of other users? (Mitä hyötyä sinulle on että näet TWIN:stä muiden käyttäjien sijainnin?)

- 13) How would you develop the location data that TWIN offers?
(Miten kehittäisit TWIN:n tarjoamaa sijaintitietoa?)
- 14) How has TWIN helped you communicate with your friends?
(Miten TWIN on auttanut sinua kommunikoidaan kavereidesi kanssa?)
- 15) How has TWIN helped you communicate with unfamiliar people?
(Miten TWIN on auttanut sinua kommunikoidaan vieraiden kanssa?)
- 16) How well does the feeling that there are other users present in the service convey to you in TWIN? (Kuinka hyvin sinulle välittyy TWINissä tunne, että muita käyttäjiä on läsnä palvelussa?)
- 17) How has TWIN affected your social relationships?
(Miten TWIN on vaikuttanut reaali maailman ihmissuhteisiisi?)
- 18) Have you sometimes continued in the real world the conversation started in TWIN?
(Oletko joskus jatkanut TWINissä alkanutta kommunikointia reaali maailmassa?)
- 19) How do you protect your privacy in TWIN?
(Miten suojelet yksityisyyttäsi TWIN:ssä?)
- 20) With what kind of things would you like to protect your privacy in TWIN?
(Millaisilla asioilla haluaisit turvata yksityisyyttäsi TWIN:ssä?)
- 21) What kind of things have increased your trust in TWIN?
(Minkälaiset asiat ovat lisänneet luottamustasi TWIN:iin?)
- 22) What kind of things have decreased your trust in TWIN?
(Minkälaiset asiat ovat vähentäneet luottamustasi TWIN:iin?)
- 23) What kind of things have increased your attachment to TWIN?
(Mitkä asiat ovat lisänneet kiintymystäsi TWIN:iin?)
- 24) What kind of things have decreased your attachment to TWIN?
(Mitkä asiat ovat vähentäneet kiintymystäsi TWIN:iin?)
- 25) What has been most pleasing in the use of TWIN?
(Mikä on ollut miellyttävintä TWIN:n käytössä?)

26) What has been most unpleasant in the use of TWIN?

(Mikä on ollut epämiellyttävintä TWIN:n käytössä?)

27) In which way has the N900 device restricted the use of TWIN?

(Millä tavalla N900-laite on rajoittanut TWIN:n käyttöä?)

28) In which way has the N900 device supported the use of TWIN?

(Millä tavalla N900-laite on edesauttanut TWIN:n käyttöäsi?)

29) What would you do if you were allowed to develop TWIN?

(Jos saisit kehittää TWINiä, mitä tekisit?)

Do you have something else on your mind? Thank you!

(Tuleeko sinulle nyt mieleen jotain muuta, mitä haluaisit sanoa? Kiitos!)