Towards understanding how users decide about friendship requests in Online Social Networks

by

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Abstract

Accepting friend requests from strangers in Facebook-like online social networks is known to be a risky behavior. Still, empirical evidence suggests that Facebook users often accept such requests with high rate. As a first step towards technology support of users in their decisions about friend requests, we investigate why users accept such requests. We conducted two studies of users' befriending behavior on Facebook. Based on 20 interviews with active Facebook users, we developed a friend request acceptance model that explains how various factors influence user acceptance behavior. To test and refine our model, we also conducted a quantitative study with 397 participants using Amazon Mechanical Turk. We found that four factors significantly impact the receiver's decision towards requests sent from strangers, namely, knowing the requester's in real world, having common hobbies or interests, having mutual friends, and the closeness of mutual friends. Based on our findings, we offer design recommendations for improving the usability of the corresponding user interfaces in order to help users make more informed decisions.

Preface

The chapter 4 and 5 of this thesis have been published. The author of this thesis performed the users studies presented in chapter 4 and chapter 5. He also analyzed the data from those studies. He authored the corresponding paper, under the supervision of Dr. Konstantin Beznosov who provided feedback and guidance throughout the research process. Below is the details of the published paper:

- Hootan Rashtian, Yazan Boshmaf, Pooya Jaferian, Konstantin Beznosov.(2014, July). To Befriend Or Not? A Model of Friend Request Acceptance on Facebook. In Proceedings of the 10th symposium on Usable Privacy and Security. ACM.

Two user studies were conducted as part of this research. For the first study (explained in chapter 3), we submitted a human ethics application with the BREB number of H13-01452 to UBC Behavioural Research Ethics Board. For the second study (explained in chapter 4), we submitted an amendment (with the same BREB number) to the first study application. The ethics application and its amendment were approved by UBC Behavioural Research Ethics Board.

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Acknowledgments

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Lastly, I would like to thank my family, my parents in particular, for the support and encouragement through my entire life. Indeed, words are not capable of conveying my love to them.

To my beloved parents, and my dear brother.

Chapter 1

Introduction

Users of Facebook-like online social networks (FOSN) are not careful when accepting friend requests from strangers, i.e., those who they do not know in real life or online communities [13, 51]. This behavior can be exploited by an attacker to run an infiltration campaign in a target FOSN [17]. Such malicious campaigns are a growing cyber-security threat [22], where an attacker controls a set of user accounts and exploits them to befriend a large number of benign users.

Large-scale infiltration has three alarming implications [17]: First, the social graph of the target FOSN is compromised and polluted with a large number of non-genuine social relationships. This means that third-party services and websites have to perform appropriate "cleaning" to mask out fake accounts and their relationships before integrating with or using such a FOSN. Second, and other than online surveillance, the attacker can breach the privacy of users and collect large amounts of personally identifying information (PII), such as email addresses, phone numbers and birthdates, which have considerable monetary value in the Internet underground markets [16]. This could happen by having access to PII after

making connections with other accounts. In addition, this information can be used to run follow up, highly personalized e-mail spam and phishing campaigns [39]. Third, the attacker can exploit the infiltrated FOSN to spread misinformation as a form of political astroturfing [56], or even influence algorithmic trading that uses opinions extracted from FOSNs to predict stock markets [12, 15].

Preventing large-scale infiltration, or at least limiting its scale and impact, is important not only to users but also to FOSN operators and social media-based businesses. Improved technology support for FOSN users in helping them to make better decisions in regards to friend requests is expected to reduce the associated risk. This, however, requires a better understanding of user's befriending behavior in FOSNs, particularly what makes them to accept or decline friendship requests.

Our research bridges this knowledge gap. In particular, we aim to answer the following general research question: *Why do FOSN users accept friend requests from strangers?* In our studies, we focused on the scenario where a FOSN user receives a friend request from another, a stranger in particular, and investigated the factors that influence the user's decision on whether to accept this request. Moreover, we also studied the process that users go through, when accepting friend requests, including identity verification, new friend management, and privacy settings updates.

In order to understand users' behavior in FOSNs, we designed two studies: a qualitative, exploratory study and a quantitative, confirmatory study. We received an approval for both studies from our university's research ethics board.

First, we conducted a set of semi-structured interviews with 20 active Facebook users (Section 4). The goal of conducting this exploratory study was to understand users' behavior in FOSNs in response to friend requests, and explore the factors

that influence their decisions. To the best of our knowledge, there is no related qualitative work to support our research questions. Therefore, we used Grounded Theory [21] in our exploration to develop a model that captures such a behavior.

In the confirmatory study (Section 5), we refined and partially tested the developed model, by conducting an online survey among 397 Mechanical Turk (M-Turk) workers. The goal was to identify prominent factors that highly impacted users' decisions in practice.

Based on our findings, we offer recommendations on designing FOSN interfaces for reviewing and responding to friend requests (Section 6). While defending against large-scale infiltration is challenging [18], we hope that progress in this research direction will lead to the improvement of existing security defenses and make them less vulnerable to both human exploits (i.e., automated social engineering [38]) and technical exploits (i.e., platform hacks [63]).

Chapter 2

Literature Review

In this chapter, we aimed to investigate the literature in order to point out the previously work done regarding friendship formation. Since we used Grounded Theory approach, we were not allowed to conduct comprehensive literature review in order to avoid having any bias in developing the OLFFA model. As the literature review, we cover related work in usable security and privacy community as well as social science community. Please note that regarding the novelty of our research problem, literature review does not give us the ability to make specific comparison between our work and results with previous work. However, we try to highlight the similarities and differences between friendship acceptance in FOSNs and real life.

2.1 Overview of friendship acceptance in social science literature

Majority of empirical studies on friendship concentrate on the friendship choices of individuals [33]. It is also worth to mention that although the context of these studies is the real life friendship, the model of friendship that was adopted by them

is similar to the model of friendship in FOSNs where in the first step, somebody (such as a user in FOSN) wants to be friend with another person. Therefore, he requests a friendship and then will wait to receive the answer. For adopting such model, there is theoretic work in the literature, which conceptualizes the friendship formation as "a series of tentative moves from one person to another one" [33]. The previous work also point out to the following interesting point. Basically, exchange theorists believe that an important point regarding the process of friendship formation is the analysis of a trade-off between cost and benefit, which means that in order to make a decision if having a friendship relationship is too costly or not [14, 31, 37, 65]. This implies the existence of a decision making process, which we also had in our model. Also, it implicitly indicates that the process of friendship formation includes a request and acceptance/rejection similar to nowadays friendship formation in FOSNs. Overall, these empirical studies investigate the distribution of friendship choices across a group or class. In other words, the goal is to find out if friendship offers are accepted or rejected and how this process takes place. The process is discussed such that in order to form a friendship, the receiver should know that there exists a friendship offer. This could happen by direct communication or by an indirect or unclear message to avoid embarrassment of receiving rejection. However, this is not how communication of sending a friend request occurs in FOSN as the sender should explicitly send a friend request to the receiver.

Then the next step is to make a decision about the friend offer after recognizing it. As mentioned before, this process is the same as the "decision making" process in our model. However, there are differences in the execution of this process. The decision is highly dependent on the benefits that will be obtained after having a new

friendship such as making a connection with somebody who has a higher status in specific directions such as common interests and social connections. However, the literature includes work that shows issues in friendship formation of people with unbalanced statuses [14]. For instance, it is usually difficult to ignore the large gap between two people even if there is other attractiveness between the two. This is also aligned with some of the friendship factors we have such as knowing the person in real life (KRL) or closeness of friendship in real life (CFR). Another interesting point during the literature review was that we found the environmental factors among the factors that impact the process of decision making about friend offers. For example, in the case that a person receives many friend offers, time constraint makes it difficult to decide about all the offers in the sense that it is not possible to accept all of them and also thinking properly to make an accurate decision [34]. In addition to time limitation, there are other factors such as initiator attractiveness that are considered for deciding about a friend offer. In general, we interpret these factors as a subset of friendship factors revealed from our interview study.

2.2 Overview of friendship acceptance in online social networks literature

There are many research studies that have been done to examine the Facebook usage by its users. If we want to categorize them based on the subjects it includes a long list of topics such as characteristics of profile elements [26], self-presentation [64], social capital, social grooming, and privacy concerns [32, 41, 55]. By reviewing the online social network literature, we could find previous work related to friendship formation (not particularly friendship acceptance) and

as the result, we highlight the most related points here.

An important point from the results of these studies is that they show negative and positive sides of using online social networks. Examples of negative side are the possibility of stalking and identity theft while the positive side includes finding new friends as well as getting in touch with old friends, family, and other users as well as increasing knowledge and information in different contexts by seeking and sharing information. It is mentioned in the previous work that emergence of the internet and then online social networks help people to keep up their existing connections and relationships [42, 54]. In addition, online social networks have served as a tool to form romantic connections [50] as well as build up virtual communities [57]. In particular, online social networks such as Orkut [6], Facebook [3], Twitter [8], Pinterest [7], MySpace [5], etc. allow users to create accounts in order to share their information with other users including their family, relatives, friends, acquaintances, and even people they might not know in real life. In order to initiate friendships in online social networks, there are factors that are important to be considered. There is also work [46] on finding factors that influence the response rate in social question and answering behavior, which is similar to our study in the sense that it also investigate impact of some factors on a behavior. However, this study was different from ours in many ways including methodology and research goal. For example, we found the (friendship) factors based on our exploratory study results, which were grounded in our data while they formed a set of factors from the literature.

There is also work that discusses some friendship factors. For instance, having personal information is specified as a fundamental requirement by *Parks et al.* [54]. However, it is not clear how this information gathering should take place

although other work has pointed out some types of information that is shared by social network users such as name, email address, physical address, phone number, academic classification, major, gender, etc [64]. Also, *Ambady et al.* believes that visual cues play an important role as they are important for initial impressions between people who are not in a friendship relation [9]. There is also work about usage of photos, wall posts, and friend list by Facebook users to attract other users to their profiles. It is mentioned that these cues would provide information that can give positive impression to other users [66, 67, 69]. *McKenna et al.* pointed out that common interests are good examples of initiating connection on the internet, which confirms our finding regarding having common hobbies and interests as a cue for being friend with other users [50]. Another work tried to focus on factors that impact decision of users to friend or de-friend others on Facebook [1]. Our results partially confirm the results of this study in the sense of the friendship factors that are employed by participants. For example, results of this study show that knowing someone in real life is the top reason for befriending someone (82%). Also this study shows that users activity (as we call it UAP) and real world interactions (we point it out as different factors such as KRL, CMF, CRF) are important for befriending. There are also differences in the results. For example, this study points out to gender difference as an important factor that plays an important role in making befriending decisions in the sense that men are mostly use social media for dating and networking while women use it for dramatically different purposes such as getting promotions or giving positive feedback. Consequently, men users add friends based on attractiveness or business networks and women add friends based on knowing people in real life. While we did not find notable gender difference in our exploratory study, we did not consider it in our second study and

also in our data analysis. Lack of finding data in terms of gender difference could be because of different reasons. First, it could be due to lack of representativeness in our sample. We could have found related data points, if we had collected more data (more interviews). Second, this could be due to the change of users' behavior on Facebook as the aforementioned study was done in 2011, which is rather old in the fast changes happening in social media. Moreover, we believe that is could be due to the difference between the goal of our study and this study as we were mostly focused on behavior of users towards stranger's request. There is also another work, which is related to unfriending behavior (i.e. removing friendship connection) of users in FOSN [61]. According to the results, authors believe that there are 4 online factors (unimportant/frequent posts, polarizing posts, inappropriate posts and everyday life posts) and 2 offline factors (disliked behavior and changes in the relationship) impact users' behavior in terms of unfriending. Although we faced these factors in our qualitative study, we found that among online factors, users are more sensitive to inappropriate posts for removing their Facebook friends. Regarding the offline factors our qualitative data also agrees with their results. Although these studies discuss some friendship factors, but the way they envisioned the problem was different as they were focusing on specific factors and they were not including and even investigating other potential factors. Also, these studies have been conducted without considering the potential connections to the strangers (but we did).

While there is work that shows Facebook users use it as a media to maintain their relationships with shared social groups (e.g., classmates, high-school friends, elementary school, colleagues) [26, 44, 55, 69], there is also work showing that users are interested in making connection with people out of their friends circles

in real life [68], which shows the possibility of users in having connections with strangers as they might make mistakes in evaluating friend requests that they receive from others. Another study also shows that around 50% of online social networks use these websites to make new friends [44]. This study also reports that 47% of teen boys and 28% of teen girls have friends in their profiles that have never met them before. Furthermore, another study shows that 15% of friendships in Facebook is between people who have not met each other in real life [62]. This evidence shows possibility and existence of having connections with strangers (somebody who is not know in real life).

On the other hand, there is previous work on privacy issues related to the usage of online social networks, which could be resulted from connection with strangers. For instance, companies collect information from social networks for marketing goals [35], teenagers were raped by people who have been on their Facebook profiles [10], and teenagers reveal their private information [11]. Another example is the work, which shows that users' intention does not match with their privacy settings [45, 48]. Another study showed that users have difficulty in understanding the privacy settings and cannot configure them correctly [25]. These privacy incidents motivate our research problem to understand users' befriending behavior. As the most related work to ours, Johnson et al. showed that the main concern is insider's threat rather than the outsider's [40]. We believe that focus of our work is different as our concern is to understand user's behavior towards friendship requests rather than how they manage their privacy settings. Moreover, we believe that stranger's threat still exists as 62% of our sample reported to have at least one stranger in their friendlist.

There is work on definition of privacy and digital privacy in particular, to clar-

ify what should be expected by users in terms of privacy [52]. On the other hand, it has been shown that this is not always fault of systems that results in privacy and security issues and humans are a major cause of these failures [58]. Therefore, it is necessary to consider humans in designing systems. Cranor et al. proposed a framework to reason about the human in the process of designing secure systems [24]. This framework was insightful during the process of qualitative data analysis to form our model.

Finally, we found few studies that were somehow related to the connection of social network users with strangers. For instance, there is a study, which focuses on the willingness of students who have Facebook profiles with their faculty. As the results show, at least a third of students believed that faculty should not be on Facebook. Although this result implicitly convey that this could be assumed as a connection with stranger, there are limitation regarding this study including the sample size, representativeness of the study as well as the outdated time of the research, which is back to 2006 where Facebook was used widely only by by students [36].

Chapter 3

Methodology

In order to understand users' behavior in FOSNs, we chose to have two studies: a qualitative, exploratory study and a quantitative, confirmatory study. We received an approval for both studies from our university's research ethics board. The rest of this chapter discusses about each of these two studies with more details.

3.1 Design of the qualitative study

The goal of conducting an exploratory study was to understand users' behavior in FOSNs in response to friend requests, and explore the factors that are involved in this process. Since there is no related qualitative work to support our research questions, we used Grounded Theory in our exploration to develop a model that captures such a behavior. As it is suggested by previous work, computer engineering research should focus on evidence-based discipline rather than having advocacy based discipline [60]. Therefore, Grounded Theory would be a good choice as any theories or models are developed according collected evidences or data. On the other hand, Grounded Theory has been accounted as the appropriate approach

to answer the question of "What is going on?" or study areas that have not been studied [59]. In the case of our project, we wanted to understand how FOSN users behave and make decision when they receive a friend request. In addition, we wanted to understand what factors are involved in the process and what factors could potentially impact users' decision about requests coming from strangers. In the following section, we discuss more details about Grounded Theory and different versions of it, and justify employing this approach and also the version we use for this project.

3.1.1 What is Grounded Theory?

According to the literature, Grounded Theory is an integration of a set of hypotheses generated to develop a theory about a substantive area in a systematic way [29]. The intuition behind its name (i.e. grounded theory) is that a theory is developed in a systematic data-centered process [27, 30]. Therefore, the theory is grounded in collected data. Glaser at al. point out to the goal of Grounded Theory as an approach to generate concepts and categories that account for a pattern of behavior [28]. However, as Adolph et al. mentioned, mission of Grounded Theory is to generate a mid-level theory, which describes processes rather than providing a universal truth although it might be different from notion of a theory in mathematics and engineering.

3.1.2 Different versions of Grounded Theory

There are three versions of Grounded Theory. The first one, which is the original version of the method was introduced by Glaser and Strauss in their book "The Discovery of Grounded Theory" [27] in 1967. The second version was described

by Strauss and Corbin in the book "Basics of Qualitative Research" in 1990 [23]. The latest version was introduced by Charmaz in her book "Constructing Grounded Theory" in 2006 [21]. These three versions of Grounded Theory are still used by researchers. The choice of the most appropriate version depends on research problems and also the context in which research is done.

In our case, we decided to choose Charmaz's version of Grounded Theory as it is more flexible in the sense that it allows researchers to interact with participants in the process of data creation and analysis as she mentioned in her book [20]:

> "Data and analysis are created through an interactive process whereby the researcher and participant construct a shared reality."

Using the Charmaz's version of Grounded Theory, we ended up with a model from our qualitative study. We provide more details about the qualitative study in chapter 4.

3.2 Design of the quantitative study

For the quantitative part, we planned to test our findings (i.e. OLFFA model and friendship factors in particular) from the qualitative part on a representative sample and measure the fraction of users who employed those factors. Also, we were interested in characterizing the behaviors of FOSN users and figure out how friendship factors are used by users. For this aim, we developed and conducted an online survey using Amazon Mechanical Turk (M-Turk). There are three reasons for conducting the survey on Amazon M-Turk. First, it is widely adopted by many researchers in different fields of research [19, 43, 53]. The second reason is that previous work shows: "MTurk participants are slightly more demographically di-

verse than are standard Internet samples and are significantly more diverse than typical American college samples" [19]. Also, previous work shows that collected data from Amazon M-Turk is as reliable as the data collected from traditional methods [19].

After defining the survey instrument (i.e. Amazon M-Turk), we designed the survey questionnaire. Complementing information about the survey as well as the analyses and results are available in Chapter 5 of the thesis.

Chapter 4

Exploratory Study

The study was in the form of semi-structured interviews. In what follows, we give more details about the study, including research questions, recruitment procedure, data collection and analysis.

4.1 Grounded Theory approach

We chose Grounded Theory as the approach of this study as it is an appropriate method for research in areas that have not been previously explored, especially when a new perspective might be beneficial [59]. Among different ways to apply Grounded Theory [21, 23, 27], we chose to follow the definition proposed by Charmaz [21] because it provides a more flexible format for data analysis.

4.2 Research questions

In the exploratory study, we aimed to understand users' befriending behaviour in response to friend requests, and to explore the factors that impact their decision. By applying the procedures of grounded theory coding, we were able to find new in-

formation, concepts, themes, and categories to develop a theoretical model, which helps in answering the following research questions:

- **RQ1:** What are the factors that influence users' when responding to friend requests in general, and to friend requests sent by strangers in particular?
- **RQ2:** What are the actions the users take before making a decision about a friend request?
- **RQ3:** What are the actions the users take after making a decision about a friend request?

4.3 Participant recruitment

We posted the recruitment notices on local Craiglist and Kijiji websites. We also distributed flyers across our university's campus. In the recruitment notice, we included a brief description of the study and a hyper-link to an existing Facebook profile, and asked potential participants to send a personal message to that profile describing their interest, along with their email addresses.

We asked potential participants for their email addresses so that we have a reliable way to communicate urgent messages without depending on Facebook (e.g., unplanned changes in the interview schedule).

The owner of the profile was a graduate student in our department who was not affiliated with our research lab and was recruited to mediate the initial communication with potential participants. The purpose of recruiting a third party (i.e., the mediator) was to avoid any potential linkage between the user profile used for recruitment and our study. The mediator signed a non-disclosure agreement stating that all data collected through mediation would be immediately erased after

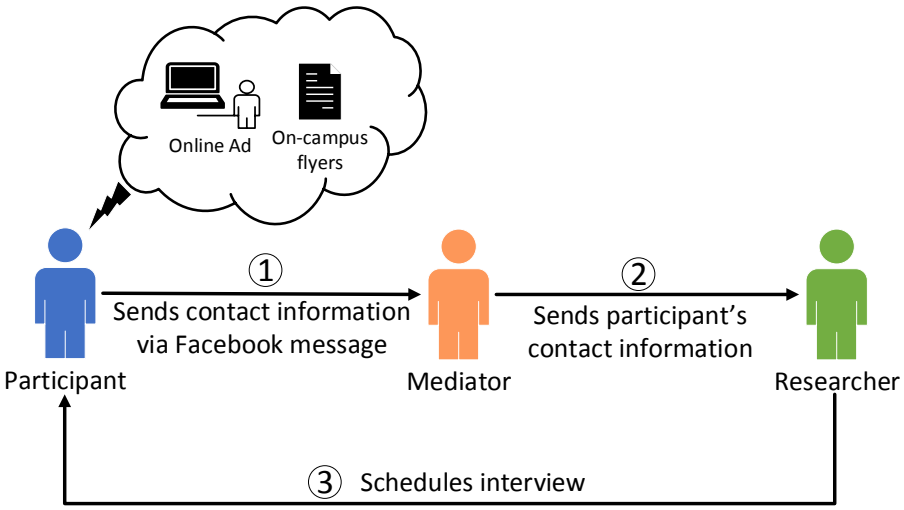

Figure 4.1: Mediator role

relaying them to us, and that all information about the study would not be shared externally.

Overall, the mediator, denoted by *M*, operated under the following protocol, as illustrated in Figure 4.1:

1. A potential participant *P* uses Facebook to send a personal message to the mediator *M*, which contains *P*'s email address and interest in the study.

2. *M* sends to the dedicated researcher an email including *P*'s Facebook user identifier along with *P*'s email address.

3. Once the researcher receives the email from *M*, he asks *M* to permanently delete the message that was sent by *P* and not to respond to any interactions initiated by *P*.

Using the email addresses of potential participants, we used e-mail to schedule

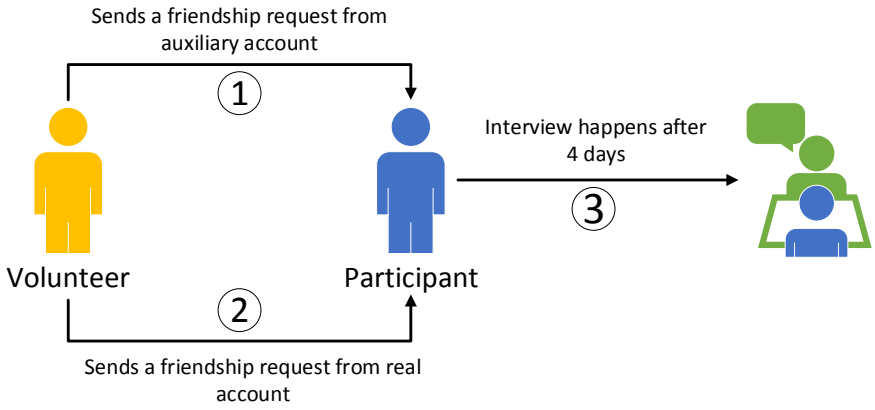

Figure 4.2: Volunteer role

interviews with them. We used the mediator to avoid inaccuracies due to self-reporting, when it came to identifying which of our participants tend to accept friend requests from strangers. This is why we had another volunteer who sent prospective participants friend requests from two other dedicated Facebook user profiles. The first user profile was a real account managed by another volunteer, while the second one was an auxiliary account that we created for the purpose of this study.[1] We aimed at reducing the chances that the participants knew the real account. To this end, we excluded students in our department from participating in the study.

As illustrated in Figure 4.2, the volunteer controlled both accounts and sent friend requests to potential participants according to our instructions. The volunteer, who was a graduate student from our department but not affiliated with our research lab, signed a non-disclosure agreement that prohibited him from both in-

[1]The auxiliary account represented a male graduate student attending our university. The profile included a publicly available, generic picture of a man in his mid 20's.

teracting with potential participants and sharing any collected information.

To avoid any suspicion among the participants in regards to the volunteer's account, we asked the volunteer to remove Facebook friends made for the purpose of the study after the interviews were finished, rather than before the interviews. While there was a risk of two participants having a pre-existing social connection (either online or offline) and seeing that the one is a friend with the volunteers, which could have influenced the other participant, none of the interviewed participants indicated that this was the case. After each interview, we sent a debriefing message via Facebook to thank the participants for their interest in our study and provided them with more details about our research.

4.4 Data collection

We began data collection when we started conducting the interviews. Our interviews were semi-structured, which gave us the flexibility to adjust and add new questions. We performed data analysis concurrently with the interviews in order to inform each new interview with the results obtained from the previous ones.

Each interview followed roughly the interview guide reproduced in Appendix A and had the following 6 parts:

1. Overview of the project.

2. Participants' demographics (e.g., age, gender, education, occupation, language) and Facebook usage-related questions (e.g., membership time, frequency of usage).

3. Participants' befriending behavior in general, and their responses to friend requests in particular. For instance, we asked questions about participant's

friends, factors or criteria they employ to make a decisions about friend requests.

4. Participants' attitude towards their privacy and security.

5. Participants' attitude towards befriending strangers, and whether they had befriended strangers before.

6. Debriefing participants and concluding the interview. During this part of the interview, we also informed them about the friend requests that our volunteer sent. We observed each participant's reaction and asked each participant who accepted any of the two requests why they did so. We also asked participants if they had any suggestions regarding the interface design that might help them make more informed decisions.

As we mentioned earlier, interviews were in the semi-structured format and we asked questions in addition to the interview guide (Appendix A). For example, we asked questions about the potential difficulty of the user interface or obfuscation of the UI.

As an iterative process, we analyzed the data by searching for patterns and forming concepts that were gathered into categories. We also wrote memos during the process of analysis to capture our understanding about the emerging categories and relationships among them.

Thanks to the iterative data analysis performed between interviews, we were able to detect "theoretical saturation" [28]. After 15 interviews, as Figure 4.3 shows, we reached the plateau where further data collection did not add new categories.

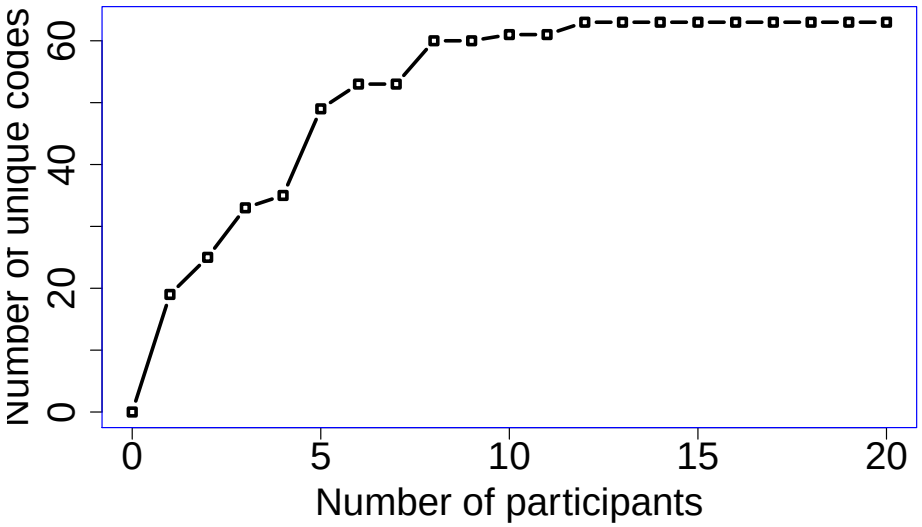

Figure 4.3: Theoretical saturation of interview data

This is why we stopped data collection after interviewing 20 participants. Their demographics are summarized in Table 4.1. All interviews were conducted in person at our university's campus. Each interview took about 50 minutes on average.

4.5 Data analysis

As specified earlier, we employed Grounded Theory for the exploratory study. In Grounded Theory, data analysis involves searching for the concepts behind the answers. We transcribed, anonymized, and analyzed the collected data after each interview with an average turn-around time of 4 days. We used a web application tool called Dedoose for the analysis [2]. In what follows, we describe each part of the analysis in detail.

Open coding

As the first step of coding, we identified, named, described, and categorized phenomena found in the collected data. Open coding resulted in a set of 63 unique codes, including both abstract (e.g., befriending behavior) and concrete labels (e.g., Facebook frequency of use). The intuition behind having abstract labels was to help develop a model. At the end, we had in total 2,620 coded excerpts, with an average of 131 per interview. We performed triangulation by having two other coders on four of the interview transcripts (interviews numbers 2, 6, 8, 11). The codes generated by the other two coders turned out to be subsets of codes generated by the main coder. The reason was that we reached saturation after 14 interviews and we wanted to make sure about this issue. Although we did not find new themes from the triangulation, we kept collecting data for another 6 interviews and we stopped data collection as we did not find new findings during data analysis.

Axial coding

After open coding, we started to relate the generated codes to each other and ended up with 7 categories grounded in the collected data. The categories are *friendship factors*, *privacy and security awareness or concerns*, *investigation actions*, *decision execution*, *maintenance actions*, *environmental factors*, and *interface capabilities*.

Selective coding

The aim of selective coding was twofold: (1) to identify the main category, which ended up being **decision making process for friend requests**; and (2) discarded all categories that were not related to the core category, e.g., *fancy interface features*.

Demographics Type	Range	# of Participants
Age	19-29	11
	30-39	6
	40-49	2
	50-59	0
	60-69	1
Gender	Female	12
	Male	8
Facebook Membership (years)	0-2	7
	2-4	9
	4-6	3
	6-8	1
Facebook Friends	0-100	6
	100-500	9
	500-1000	5

Table 4.1: Demographics of interview participants

Finally, we read the transcripts again and selectively coded any data related to the core category.

Theoretical coding

During this stage of analysis, we applied to the data the developed theoretical model. We integrated the model into related data in order to explain the core category. The outcome was a grounded model, or theory, about the lifecycle of Facebook friend acceptance, which we discuss in the following section.

4.6 Results

We now present the results of our exploratory study. First, we start by discussing the overall model, and then continue with detailed descriptions of the model components and the relationships among them.

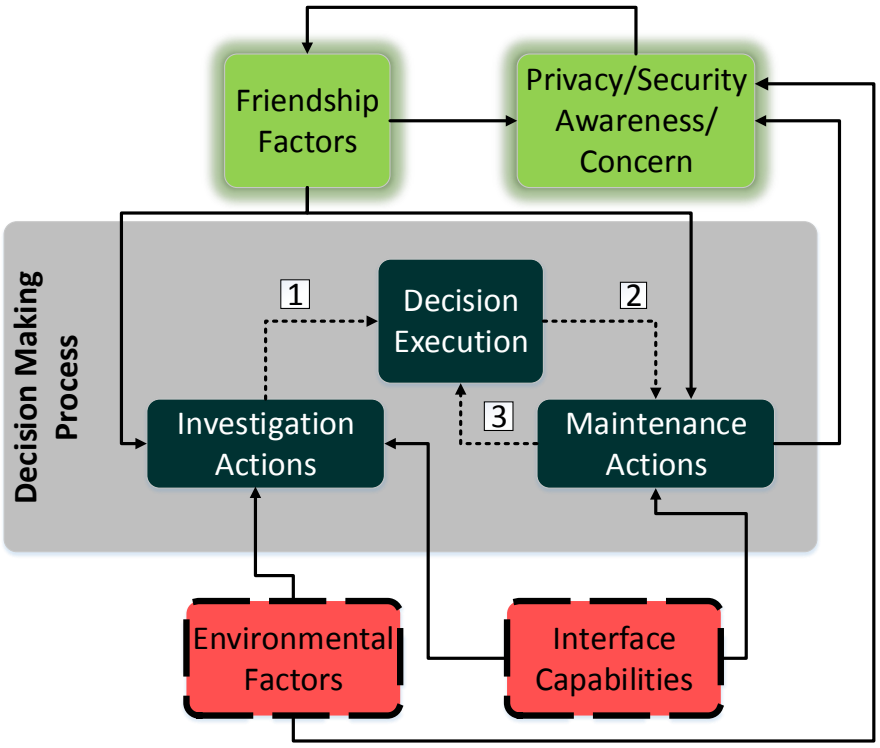

Figure 4.4: Online lifecycle of Facebook friend acceptance (OLFFA) model. Shaded components on the top are the internal factors and components with hyphenated borders are the external factors. The middle box, which includes 3 components, represents the decision making process. The dashed arrows represent decision making flow. The solid arrows represent the impact of components on each other.

The overall model

We refer to the developed model as the **Online Lifecycle of Facebook Friend Acceptance** (OLFFA). It includes 7 components, as shown in Figure 4.4. Each component is derived through the coding steps that were described earlier and is representative of a set of users' behaviors.

The factors that we found to have influence on the process of users' decision making can be categorized into four groups, to which we refer as components: Friendship Factors, Privacy and Security Awareness and Concerns, Environmental Factors, and Interface Capabilities. Since the first two components (green shaded rectangles in Figure 4.4) are user-specific and subjective, we considered them as *internal* (to the user). On the other hand, since a user does not have any direct control over the last two components (red rectangles with hyphenated borders), we call them *external* factors. The components inside the large grey box in the middle of the figure represent the decision making process, and the numeric labels indicate the flow of actions associated with decisions. The rest of this section includes discussions about each of the components and their interactions with other components, particularly, how they impact other components or how they are impacted by other components.

Friendship factors

This is the component that was brought up and discussed by all of the participants. Friendship Factors impacts Privacy and Security Awareness and Concerns of users in the sense that when users employ more restricted friendship factors, they become more sensitive about their profiles' privacy and security.

On the other hand, Friendship Factors could be impacted by Privacy and Secu-

rity Awareness and Concerns. This happens when the Friendship Factors that the users employ change due to a an adjustment of their view on their profiles' privacy and security:

> "Well, from the time my brother's account on LinkedIn was hacked, I have always concern to have my info available on the internet. So I started to accept people that I feel comfortable to share my info with them. Not like before that I was accepting almost everyone." (P9)

As the result, a user could become more conservative in making new friendships. A reverse change could happen as well.

This component also impacts Investigation Actions and Maintenance Actions. For instance, if a user relies on the similarity of backgrounds for making friendships on Facebook, an investigative action could be to check out the requester's profile in order to see her background. Similarly, finding and removing passive friends is another example of maintenance actions driven by friendship factors.

Here is the list of Friendship Factors we have discovered:

- **Knowing the person in the real world (KRL):** It was reported by participants that they care about knowing people in real world or at least in online communities (e.g., forums), when they consider accepting friend requests on Facebook. For instance, P5 said:

  > "If I do not know them, I do not accept them. I mean I should have seen a person at least once to accept them as Facebook friend."

- **Profile picture (PRP):** The profile picture is one of the most important factors for users. We encountered users who usually spend only a few seconds

to decide about friendship requests. Those users pay attention to only the profile picture, as the fastest way to make their decision. As P4 puts it:

> "I can really know from pictures. If you do not have a picture then I do not know you!"

- **Profile name (PRN):** Similar to profile pictures, the profile name is used by users especially for the case when they want to instantly decide about friendship requests. They prefer to receive requests from recognizable names, to facilitate the process of decision making.

- **Common background (CBG):** During the interviews, many participants mentioned common backgrounds and interests as friendship factors. Users tend to accept friend request from people who have common background with them. These commonalities include city and country of birth or residence, schools and universities attended, personal interests, and hobbies, etc. When we asked for the reason, the users pointed out that these commonalities work like a trigger that helps them remember the people they have on Facebook and to know them better. For example, P17 said:

  > "Although it is fine for me to have new friends based on my interests, I would prefer to be in the same city to make closer friendships."

- **Being active on Facebook (BAF):** According to our data, the fact that the friend requester is an active Facebook user is sometimes the most important factor, even more than knowing the requester. P5 expressed this by saying:

> "If they send me a request, okay, I know you. I am going to accept your request but it has been five months and you are not posting anything. You never come to Facebook. You never post anything. Okay, I am sorry. I have to delete you because you are not adding anything."

- **Gender (GEN):** The gender was another factor for participants. P5 said:

> "I think gender is effective in terms of friend requests. You know, I am sorry to say it but put a picture of a pretty girl would get hundreds of friendship requests or even messages. I have a male friend who was building a 'stable' of Facebook women. He had about 600 friends and they were all women. There is not a single male friend on the list!"

- **Number of mutual friends (NMF):** The majority of participants confirmed that the number of mutual friends is important, as it helps users to remember whether they know each other. Although it is known as a way of verification by many users, it might fail them. P2 raised an interesting point about it:

> "I used number of mutual friends as a fast approach to accept friends but later it turned out it is not necessarily good enough because I removed many friends who had large number of mutual connections with me. Maybe because I had a lot of friends, around 800, so I had many friends in common with people and it did not work all the time."

- **Closeness of mutual friends (CMF):** Some participants highlighted that,

in addition to the number of mutual friends, it is also important to know the closeness of those friends. That is, even if there are a couple of mutual friends between the receiver and the requester, it is not necessarily enough for users to make a decision. As P5 expressed it:

> "You either have to be someone I know or you have to be mutual friends with someone I really know. Anyone else I do not take requests anymore because I ran into some pretty weird people."

- **User's activity pattern (UAP):** Another friendship factor was user's activity pattern, including what kind of information is shared (i.e., either relevant or irrelevant) and how often the content is shared. For instance, P1 said:

> "I do care about what they post. If they post, like, things that I would find disturbing for me, ding!! I would delete them."

Furthermore, our participants disliked being friends with those who just monitor others' posts, and possibly report to mutual contacts:

> "My aunt turned out was watching my page and then reported my activities to my mom. And that did not go over well and I just blocked them. I would never befriend anybody who just monitors others." (P6)

Given this dislike for passive users, it was interesting to discover that some of our participants had changed their activity on Facebook over the years. They undergone a shift from active to passive users, who just read others' posts, without regularly adding any content. According to our participants,

an active user is the one who is willing to have a lot of Facebook friends and performs a variety of activities, such as sharing photos, notes, and videos, as well as posting their status, etc.

- **Closeness and quality of friendship in real life (CFR):** We found in the interview data that it is important for users to make sure how good of a friend they might become with the requester and if they might get along. For instance, P6 reported:

  > "If I know them then, it takes a little bit longer because then I have to decide because my half-brothers and their daughters have requested to be my friends. And yes, I know them but, no I do not want them on my page. Because the girls I do not get along with when they come for Christmas dinner. We only see them at Christmas time and I do not get along with those girls. My half-brothers, the one I do not – I have only met this past summer for the first time, so I do not know him and I am not interested!"

  Another participant, P5, expressed similar concerns:

  > "I found this quite upsetting but there is a woman on my site who I worked with. We were quite close at work but I did not like a number of things that she did, and you know I did not accept her request."

- **Application-based friendship (APF):** There was another factor raised by our participants where users tend to make friendships with others for the sake of receiving bonuses from some applications such as games. As a result,

such users would send and accept more friendship requests.

Privacy and security concerns and awareness:

As described earlier, this component is influenced by and impacts Friendship Factors. Maintenance Actions also impacts this component. This might happen as a maintenance activity, for example, when a user monitors a friend's profile and she ends up facing surprisingly irrelevant content posted by this friend. This observation would cause them to be aware of fake or hijacked accounts posing as close friends:

> "I remember that I found that there were two accounts for a friend of mine and I thought he had created another one. When I asked, it turned out that the first one was a fake account and he had already deactivated his previous account. So, somebody had created an account similar to his first account. I did not know that. I even checked my name to see if there is any fake account for me as well as other friends." (P17).

Another source of influence on this component is Environmental Factors in general and media in particular. Some participants noted that their awareness of privacy and security on Facebook were affected by media reports. For example, P7 shared:

> "Previously, I would just add like a lot of random people and accept requests. Later, I became more conservative, as I heard from media about leakage of users' information."

P1 also believed that there were security incidents reported by media that influenced her behavior:

> "Because there are a lot of issues with Facebook, like pictures, as there was the recent one about the girl who committed suicide and how her photo was used for some porn website so things like that. So for the pictures that I post on Facebook, they are never of my face."

P3 had similar concern describing his experience:

> "I used to post a lot of photos on Facebook but then there are issues with security. The more you post, the more you cannot take back because I read in a blog that even if you post a photo on Facebook and get rid of it from your account, just delete an album, you are still going to be on Facebook. So because of that I stopped posting photos on my account."

We also found an interesting point about the effect of security and privacy incidents in other online services, which results in change of behavior on Facebook. P10 said:

> "I had profiles on LinkedIn and Evernote but then I removed it because of some security leak in passwords. I got sensitive in terms of disclosing information on my accounts."

Interface capabilities:

Our participants reported a set of issues related to capabilities of the interface—e.g., lack of required information, device-specific design, and frequent changes of privacy settings—that would impact Investigation Actions and Maintenance Actions.

Some of the participants could not easily find desired information in order to make decisions about friendship requests. As a result, they preferred sometimes to think about requests, rather than looking for additional information on Facebook about the requesters. This raises the issue of information visibility in the interface. For instance, P3 provided the following suggestions:

> "Definitely need to have what/where they are from, what they have, if it is in academic backgrounds, then what they studied and where. And if it is just maybe a few interests that they have, [it] could never hurt, I think. Just because you look at a person and you think they are interested in photography I do not think it could actually hurt anyone. So just something along those lines that can give you more information."

Regarding the issues related to device-specific design, P8 shared her experience as follows:

> "In terms of an interface, maybe a bigger button, I think just because sometimes all those buttons look very similar and you tend to click one. If you are using your phone and looking at someone who you are not a friend of, but you want to (this has happened to me before), you want to message that person instead before you add as a friend and then by mistake because the buttons are right next to each other I would press add a friend, send a friend request, or add a friend instead of message. So when that goes out that is it. They receive it and then you cannot really retract that."

P13 mentioned another issue in this regard:

> "It really depends if I use my phone or my desktop when I accept or reject a request. Using the desktop, I spend way more time while this is not the case with my iPhone. So you would be lucky to have me on desktop when receiving your request. On iPhone, I would make my decision very quickly. If I do not remember, I would just reject."

This issue shows the gap between usability of device-specific designs of interfaces for accepting/rejecting requests.

The last issue about the interface was frequent changes made to the interface, the privacy settings in particular. Participants found it difficult to catch up with these changes.

Investigation actions:

Before making their mind in regards to friendship requests, some of our participants took one or more of the following actions:

- **Sending personal message:** Specified by many participants, sending personal message is a common technique for obtaining additional information about the requesting user, especially when he is not known to the receiver. As P7 explains:

  > "I would personally ask them on private messaging and say that I do not know you or asking some questions like 'have I met you?' "

- **Checking out photos:** It was also common among the participants to go to the profile and, if possible, check out photos of the requester. They reported

to be helpful to recognize the requester, to either make decide about the request or start communicating with the requester via messaging.

- **Looking for commonalities:** Another action taken by our participants was to explore for commonalities in terms of background, friends, interests, etc., as P5 illustrated:

  > "Do we have common interests? Do you know some friends of mine? We have something in common maybe?"

  This action seemed to be done by those participants who had new friends, in order to help them know people better, as well as those who wanted to have limited list of friends, in order to help them verify requesters, in case the profile picture or name were not recognized.

- **Checking mutual friends profiles:** Some of our participants reported that, although it was important to know if there were any mutual friends, it also took time to check out the mutual friends' profiles for evaluating the closeness of the relationship. Although it was important to some of our participants, some other participants said that they would skip this step because it was too time-consuming and required somewhat high cognitive load:

  > "I really want to know more than just number of our mutual friends and see if those are close friends but I check that when it does not take me a long time. Like less than 5 minutes otherwise I won't do that." (P13).

Decision execution:

We found three types of behavior for decision execution. (1) Some participants would make their decisions immediately after they received requests. If they could find information they needed to make the decision, then they would easily make it right away. There were other participants who would accept friend requests right away, although for different purpose. They would do so in order to find out more about the requester (after becoming friends) and then decide if they wanted to unfriend her or not.

(2) Otherwise, they would reduce their set of decision criteria, in order to expedite the process. In such cases, participants with less concerns about privacy and security would most likely accept friend requests:

> "If I get a friend request that we share mutual friends but I do not know them, I am always hoping that I can check their profile. Sometimes it is restricted so you cannot. So I accept the friend request." (P5)

(3) On the other hand, some users would leave requests as they are, and postpone further investigations.

Maintenance actions

The interview data revealed three types of Maintenance Actions that our participants took after accepting friend requests.

One of the common maintenance actions was to remove friends after a while, due to a number of different reasons. For examples, those friends that had been added in order to play face boo games, would be removed when there was no need to be friends with them. Another common reason was finding content shared by

to-be-removed users irrelevant. As a result of these actions, users may adjust their Privacy and Security Awareness and Concerns, which would eventually impact their Friendship Factors.

One other type of maintenance actions was to define different levels of access for friends. This usually happened in two ways. One was to define separate groups of friends and then specify visibility of the posts using these groups. The other way was to deny specific users the ability to see a post or any desired content on-the-fly. This means that participants sometimes set the access level manually to avoid a group of friends accessing the post. As an example, P7 said:

> "If it is for family pictures, I would just change the privacy setting to relatives. Then, I do not have to remember every one of those friends. Sometimes I do not even have to create a group for relatives though. I can remember who are my relatives."

The third type of actions was for our participants to update the privacy settings of their profiles. However, some of our participants, who were sensitive about their privacy, complained about frequent changes that Facebook privacy settings undergo:

> "It changes a lot, but from time to time I try to go back and look at it, but that could be like once a year or so." (P3)

On the other hand, we found that some participants were not even aware of privacy settings in the interface. When we asked about the possibility of access to information of their profiles, some of them did not even know if it were possible. P2 said:

> "I guess so, because I have not seen that at all. But, now that you have talked about that, to me that means there are thousands of people that can check who I am. Some groups are pretty big. I have not thought of it."

This issue with frequent changes in Facebook privacy settings illustrates the relationship between Maintenance Actions and Interface Capabilities, in which the latter impacts the former.

Environmental factors

Analysis of interview data revealed that there are three environmental factors that influence Investigation Actions and Privacy and Security Awareness and Concerns, as discussed before.

First, the participants referred to the lack of time, as a factor that influenced their decisions about friend requests. For instance, P17 said

> "I have always problem with the lack of time during break times. I have to check updates, requests, messages, etc. in just 15 minutes. I once accepted a friend by mistake, as the requester had just same name as a friend of mine and I had not checked his profile to get more info about him."

The second factor is the lack of concentration, while checking out Facebook:

> "On the way to university, I usually check out my profile on the bus. I once accepted a request when I was on the bus and that was a wrong decision. I guess I was distracted by stops and also other passengers so that I forgot to send a message to the requester." (P20)

The third environmental factor was the effect of media. As described earlier, the Privacy and Security Awareness and Concerns of our participants were impacted by media reports about security and privacy incidents.

4.7 Discussion

In order to answer the research questions, we decided to go one step back and envision the problem as part of a bigger context. Therefore, we managed to come up with a model which discusses users' behavior when they want to accept/reject a friend request. This idea was supported with the fact that there is no previous study focused on this aspect of users behavior. Armed with such a model, we would be able to uncover behavior of users towards strangers since this scenario would be a specific case of the model. We define stranger as a person who is not familiar in real life or online communities. In this regard, we indirectly asked participants about their interaction with strangers so that we can reveal more details about this scenario.

Befriending strangers:

As described in Section 4.3, before each participant was interviewed, the participant received two friend requests, one from a Facebook profile of a real user, and the other from an auxiliary profile made up for the purpose of the study. Five participants accepted at least one request from one of these accounts, and one of them accepted requests from both accounts. When we reached in our interviews the debriefing part, in which we informed the participants that these requests were from our research team, their reactions varied.

The participant who had accepted both requests said that it was okay with him

and he did not care about strangers among his Facebook friends, since he did not have any idea that anybody could make any use of his profile data. The other four participants who had accepted requests from either real or auxiliary accounts of the researchers had different attitudes. After hearing the scenario, they got nervous and one of them said:

> "I would not have accepted the request if I knew more. I saw the guy is from UBC and is a graduate student. I thought that it should not hurt."

Another participant, most of whose profile was accessible publicly, had similarly nervous reaction, especially when we explained the possibility of any user accessing his profile information. He commented that in the future, he would pay more attention regarding friend requests.

In addition, we found evidence in interview data suggesting that some OSN users don't pay attention to possible threats, when it comes to making friendship connections:

> "I seem to be a million times more strict than most people. I know some friends who accept anybody that requests. Well, I mean a lot of people do. They do take it too easy. How can you have 2,000 friends?" (P5)

Another participant had a set of "friends" from accessory shops (she did not know them) while they had access to the profile information e.g., other friends in her profile. Some participants seemed to have no criterion for making friendship. They would just add anybody, as P11 explained:

> "I am always nice to requests on Facebook, as I cannot remember that I have rejected a request."

Attitudes Towards Strangers: These observations made us more curious about users' perception of Facebook users they do not know in real life. Our analysis suggests that, when it comes to one's attitude towards strangers on Facebook, our participants can be roughly divided into three groups.

We found that one group of participants had a "take it easy" attitude towards accepting friend requests from strangers. As P1 justified:

> "I have spent some time with them on Facebook and they do not seem somebody who would cause me pain!"

As P1 mentioned, it is enough to have a feeling that a person is not going to make any trouble for them. The other reason for accepting their requests is that having less commonality might be even an advantage, as P16 illustrated:

> "I know some people in real life who have common things with me like our neighbor's kids that we lived in the same neighborhood, we went to the same school. But I do not want him to be on my Facebook profile. I prefer to have more of these unknown guys instead of our neighbor's son, as some of them post cool stuff and I don't need to be worried about my posts, because none of them would tell my dad what I am doing!"

On the other hand, for some other participants, only knowing a requester in real life did not necessarily mean that this was a right person to be friends with on Facebook. P2 illustrated this point with the following example:

> "I have like friends from primary school who ask me to be [Facebook] friends. But, in primary school you are friends with all your classroom so then it will be like your real friends. And that has not been done for 15 years. So now I do not accept them anymore if I see that we are in really different world and everything. It is my private life and I am a new person now."

P1 explains this attitude further:

> "If you have not kept in contact or you have not actually tried to stay in contact, I feel like there is no point. Long ago in the past, I do not go back there."

Users who have this attitude are less vulnerable to the threat of accepting a stranger's request.

The third group's attitude was not as clear cut as for the first two groups. As a result, participants from this group were influenced by the various factors specified in our model. This group would be also vulnerable to the threat of accepting strangers' requests, as participants from this group reported issues in recognizing people in real life or online communities.

These groups are not necessarily mutually exclusive, i.e., the same user can exhibit in the majority of cases the behaviour of one group, and yet handle some of the requests following the pattern of another group.

Accepting While Not Intending: Our analysis revealed that some of our participants would make inconsistent decisions. For instance, they would accept friend requests although they didn't have intention to be Facebook friends with the requesters, as an example of P11 illustrates:

> "Some requests are from people that I had a quick chat with them or somehow I remember them but honestly I don't want to be friends with them. However, I will accept if they send me request."

These participants seem to find it socially awkward to reject friend requests. P18 made it explicit.

> "I always have this problem with some of people I know but I don't have a really good relationship with them that I cannot say no to their request. I don't know why but I think it's better to accept rather than reject them." (P18)

Usage Differences: We discovered differences in the way our participants used Facebook, and these differences seem to correlate with they way they treated friend requests. Although it has been previously shown that users tend to use OSNs (including Facebook) to make connections and share different kinds of data, we found three "flavours" of users:

- **Contributors**: These are traditional users who both consume and contribute new content. They make friendships, share photos, share personal information, post updates, and interact with others by commenting and favoring their shared content. From the point of view of this group, the aim of FOSNs is to make an environment in which people feel free to share information with others and receive feedback. While they are willing to have more friends, they are also conscious about their profile privacy and friendship management, as P16 illustrated.

  > "I really enjoy using Facebook when I share posts or comment on

> a post and receive likes. But this is because I know my friends and feel comfortable with them"

- **Observers**: On the other end of the spectrum, there are users that avoid having social interaction and prefer to passively observe others. They have different reasons for this behavior including lack of time, security concerns, difficulty to use the interface. As the result, they do not share any information and they are willing to make connection with as many users as possible.

  > "I like Facebook as it gives me the chance to read my friends' posts and watch their photos, read news and many other things. Of course I don't share anything as I use my phone and it's really difficult to type a lot. Moreover it takes a lot of time." (P13)

- **Conscious Contributors**: In addition to these two extremes of the spectrum, there are advanced contributors who are more sensitive about the audience of their posts and other shared content. This third group of people reports more issues regarding friendship management, as P15 illustrates:

  > "What I am looking for on Facebook is to interact with others and share my info as well as see their posts. I am spending a lot of time to manage my profile and I have this difficulty to put my friends in different groups as I want to have them but I don't like to share my personal photos or posts with all of them."

To summarize, our observation indicates that we can categorize users of FOSNs into three groups, with Contributors and Conscious Contributors being more likely to have issues in terms of privacy and security of their profiles. This sheds light

on the point that privacy and security would have different meanings for users according to the type of their FOSN usage. Consequently, this may impact user's attitude towards friend requests.

Our Online Lifecycle of Accepting Friends model could be helpful for FOSN designers, when it comes to supporting users in deciding about friend requests. The model could aid in considering various factors that impact user decisions.

Chapter 5

Quantitative Study

While the exploratory study allowed us to identify possible factors that have a role in users' decisions about friendship requests, we wanted to test these factors on a representative sample and measure the fraction of users who employ those factors. Also, we wanted to characterize FOSN users' behavior and find factors that are employed significantly more than other factors for making decision about friend requests sent from other users, in particular strangers. Therefore, we decided to conduct an online survey that would allow us to collect quantitative data from a representative sample.

5.1 Research question

As previously mentioned, considering the results from the exploratory qualitative study, we chose to have another study to test the factors that were reported by participants. In particular, we were interested in characterizing users' behavior when it comes to decide about a friend request. Therefore, we aimed to answer the following research question:

- Which of the factors identified in study #1 (exploratory study) influence users in deciding to accept a friend request?

While the aforementioned question is in the position of a generic research question, we also focused on details in the sense that we considered four different groups that could potentially happen to FOSN users. These four groups include receiving friend requests from strangers and whether they are accepted (group #1) or rejected (group #2), as well as the situation that a request is sent by a known person (in real life) and if it is accepted (group #3) or rejected (group #4). Having these groups, we aimed to investigate the key factors in each group and compare them together.

5.2 Survey execution

For each of the friendship factors identified from the interviews, the survey had at least one statement (e.g., "If I recognize someone's picture, I would accept his/her friendship request on Facebook.") and asked participants to indicate their agreement on Likert scale of 1-5. For those factors that had more than one statement, we used the mean score. For testing data quality, we have included contradicting statements. For example, "I would accept a friendship request from a Facebook application." and "I don't tend to accept friendship requests sent by Facebook applications." All questions from the survey can be found in Appendix B.

We recruited 425 M-Turk participants from USA and Canada. Each USA participant received $0.50 and Canadian $0.75. It took 16 minutes on average for our participants to finish the survey. We removed 28 participants because of contradictions in their answers, which left us with responses from 397 participants.

5.3 Sample representativeness

We compared our sample demographics to Facebook demographics in order to discuss the representativeness of our sample. This comparison could give insight on limitation of our sample, which is potentially helpful for future work.

5.3.1 Age comparison

As Figure 5.1 shows, our sample is younger than Facebook users. We got more younger participants (18-24: 31% vs 23.2% and 24-34: 39% vs 24.4%) and fewer participants in higher age ranges (35-54: 25% vs 31.1% and 55 and above: 5% vs 15.6 %). We did not have any preference to recruit participants from younger age range and as mentioned earlier, we recruited participants from Amazon M-Turk. However, previous work shows that the turkers are relatively young with about 80% in 18 to 40 years old age range (Average = 31, Minimum = 18, Maximum = 71, Median = 27) [53], which could be the reason for having a younger sample rather than Facebook demographics. It is also worth mentioning that we did not have any participants in the age range of 13 to 18, as we chose to recruit participants who were at least 19 years old (due to the official rules of British Columbia).

5.3.2 Gender comparison

In terms of gender and as Figure 5.2 shows our sample consists of more male participants rather than female ones (58% vs 42%) while 53.3% of Facebook users are females and 45.7% are males.

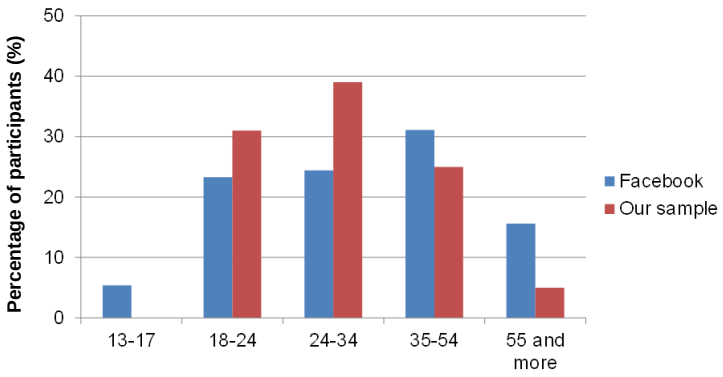

Figure 5.1: Comparison of our sample to Facebook population in terms of age.

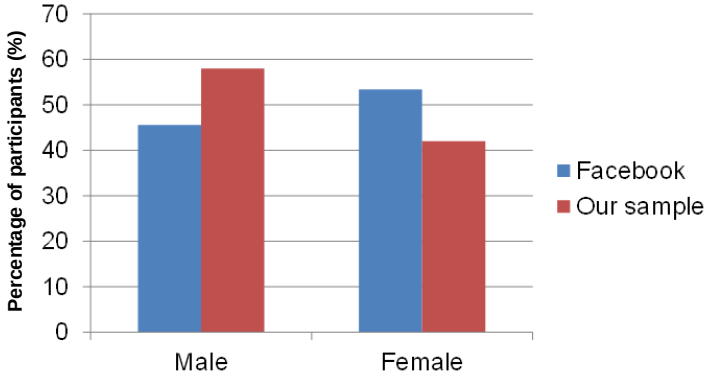

Figure 5.2: Comparison of our sample to Facebook population in terms of gender.

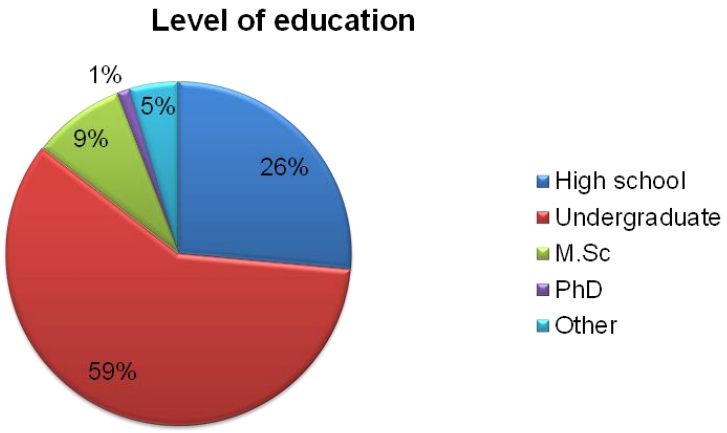

Figure 5.3: Distribution of the sample based on the levels of education.

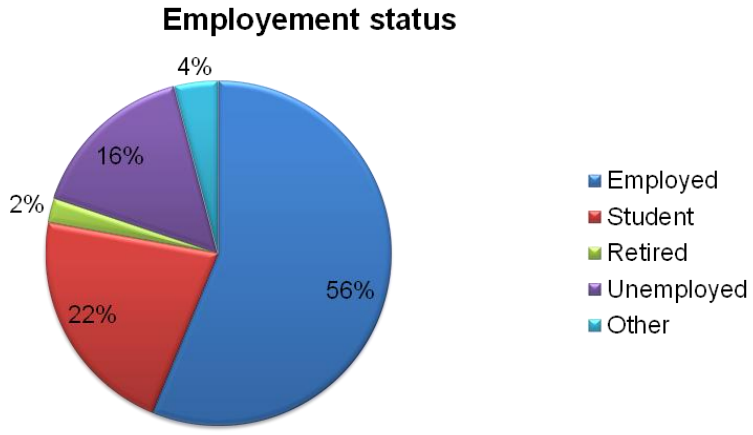

Figure 5.4: Distribution of the sample based on different employment statuses.

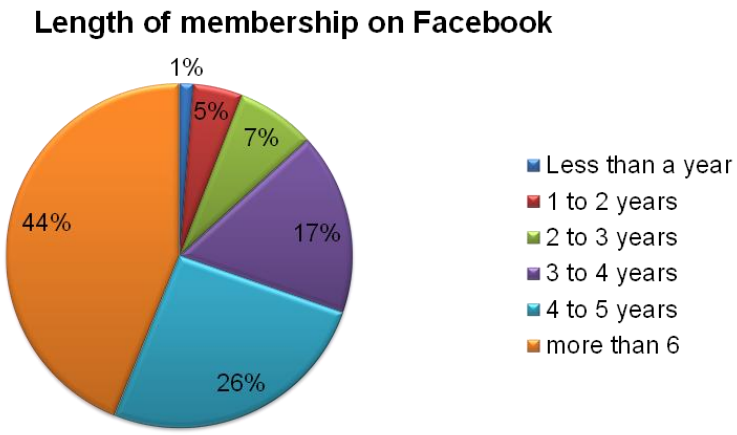

Figure 5.5: Distribution of the sample based on length of membership on Facebook.

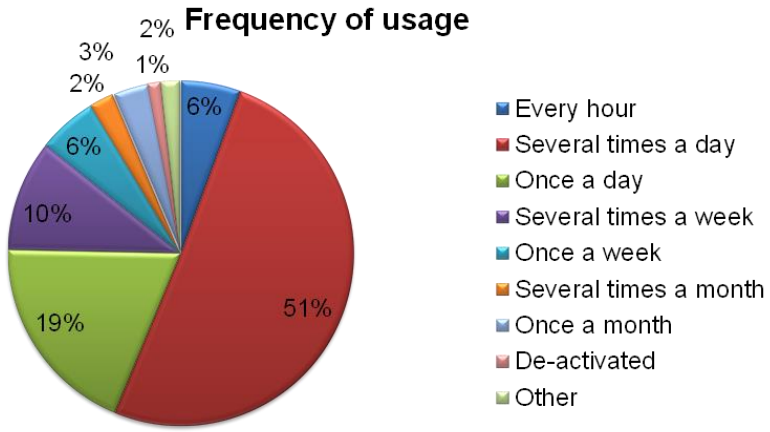

Figure 5.6: Distribution of the sample based on frequency of Facebook usage.

5.4 Results

In this section, we are presenting the results from the quantitative study. First, we provide statistics related to participants demographics, then descriptive statistics regarding employment of the friendship factors, and finally we discuss four groups that could happen to FOSN users when they receive a friend request. Analyses of these four groups would be insightful to reveal the factors that impact users' decision towards friend requests.

Participants Demographics

Demographics of our participants show diversity of the sample. In terms of age, we had participants from 19 years old to 65 and more. Gender-wise our participants were fairly evenly distributed. Participants also had diverse education levels (26% with high school or lower degree, 59% with undergraduate degree, 10% with graduate degree, and 5% had other education levels). The employment status of our participants varied, too: 56% employed, 22% students, 16% unemployed, 2% unemployed and 4% had other employment status.

We also asked our participants general questions about their Facebook usage and experience. The majority (94%) were Facebook users for more than 2 years. In terms of usage frequency, 92% reported that they login into Facebook at least once a month, while 80% login several times a week. They were also asked to go to their Facebook profile and enter the exact number of their friends. Our participants had wide range of friendship circles, with minimum of 10 and maximum 3,000 (mean 328, median 203). This shows that collected data came from users with different befriending patterns. Majority (64%) of participants receive at least one friend request in a month and only 7% receive friend requests less than once a year.

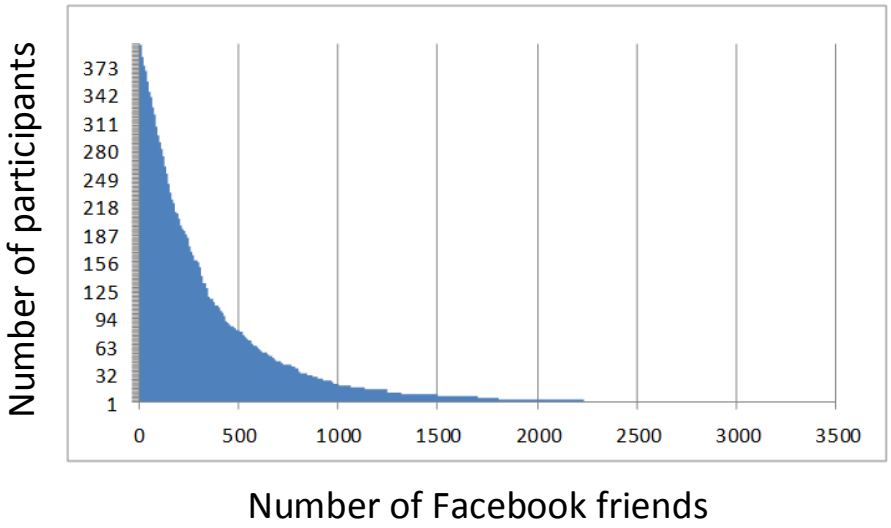

Figure 5.7: Distribution of number of Facebook friends among participants.

Friendship Factors

Figure 5.9 summarizes results of the survey on the friendship factors. The bars show the percentage of all participants who reported employing each of the factors, i.e., they agreed with the corresponding statement(s).

Starting from the most popular factors, requester's profile picture (84%) and name (82%), participants accept friendship requests if they recognize the requesters. Seventy seven percent agreed with statement "I tend to accept friendship requests from people I know in real life or online communities."

Another factor was "common background" (CBG). While 74% of participants

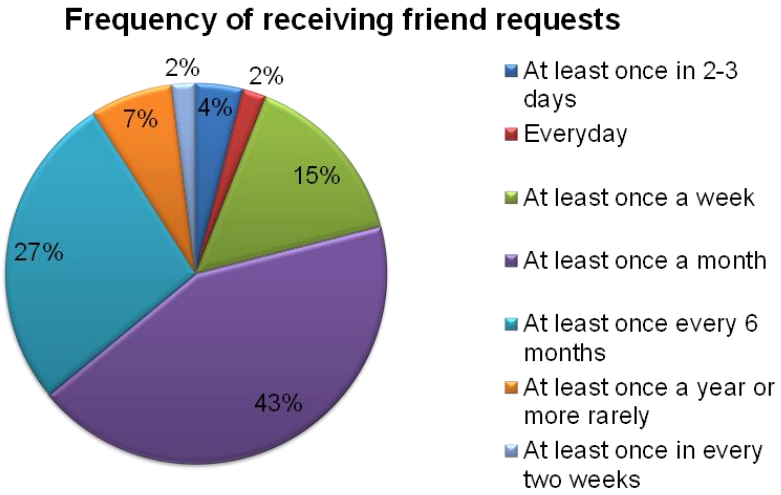

Figure 5.8: Distribution of frequency for receiving friend request.

agreed that it is important to know requester's background, the survey results show that the participants were not specifically interested in a single type of background information. And the importance varied among participants. For instance, only 15% would accept friend requests from users who were born in the same city as they were. Similarly, only 18% would accept friendship requests from users who live in the same city as they do. On the other hand, 27% would be interested in having Facebook friends from the same school/university. The most popular type was "common interests/hobbies," with 35% relying on this background information in their decisions about friend requests. This particular result was corroborated in the interviews, with participants reporting interest in new FOSN friendships with those who share interests or hobbies.

Another factor that we tested was activeness of friends, with 72% reporting interest in accepting friend requests from active users. In terms of gender (GEN),

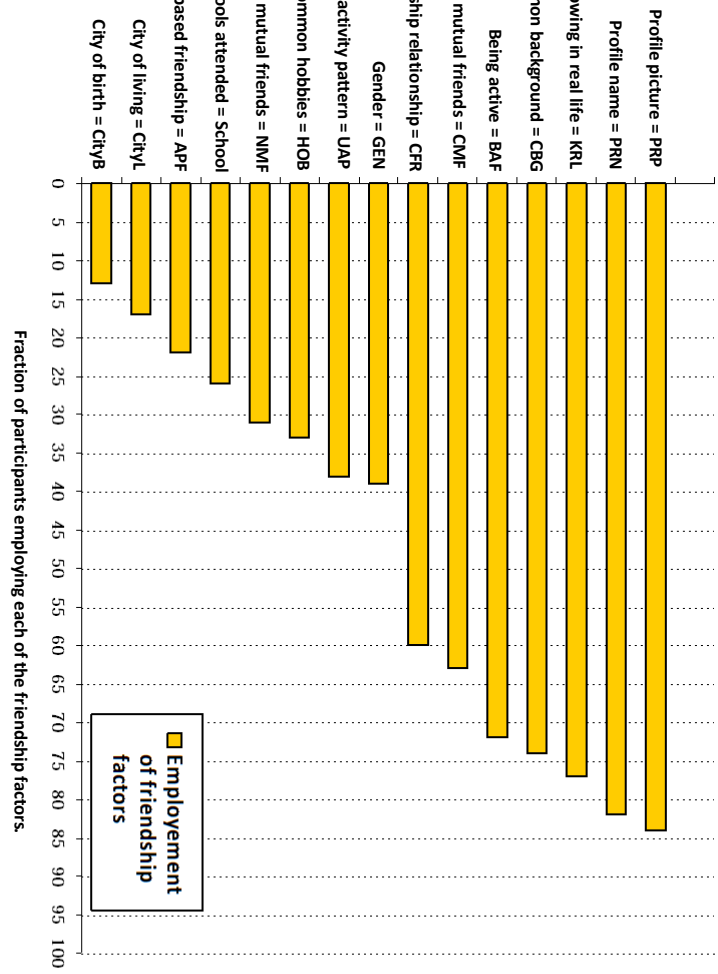

Figure 5.9: Employment of friendship factors by participants.

39% of participants confirmed they consider it during decision making for friendship requests. The "number of mutual friends" (NMF), which is currently shown in the Facebook's friendship request dialog, was only used by 31% of participants for making their decisions. On the other hand, the majority of participants (63%) do care about "closeness of mutual friends" (CMF) to them. Regarding the impact of "user activity pattern" (UAP), we found that 38% of participants were reluctant to accept a friend request if they saw irrelevant posts shared by the requester. This was expected, as our interviews showed that although people like to have access to the posts of requester, they usually do not have this level of access. The results also show that "closeness and quality of friendship in real life" (CFR) was important for 60% of participants. We also measured the number of participants who would accept "requests from Facebook applications". Results show that 22% of participants took APF into consideration, as a factor in deciding about friend requests.

Characterizing users' behavior

Regarding our interest in focusing on users behavior towards friend requests and the way they employ different friendship factors, we considered four groups in which FOSN users might be situated when they receive friend requests. These groups originate from the point that we envision the process of making decision about friend requests to have friendship factors as the dependent variables (DVs) and decision of either accepting or rejecting friend requests as the independent variable (IV). Examples of dependent variables could be profile picture (PRP), number of mutual friends (NMF), etc. Therefore, we consider four groups in which users accept/reject friend requests from known/strangers. In the following section, we explain each group.

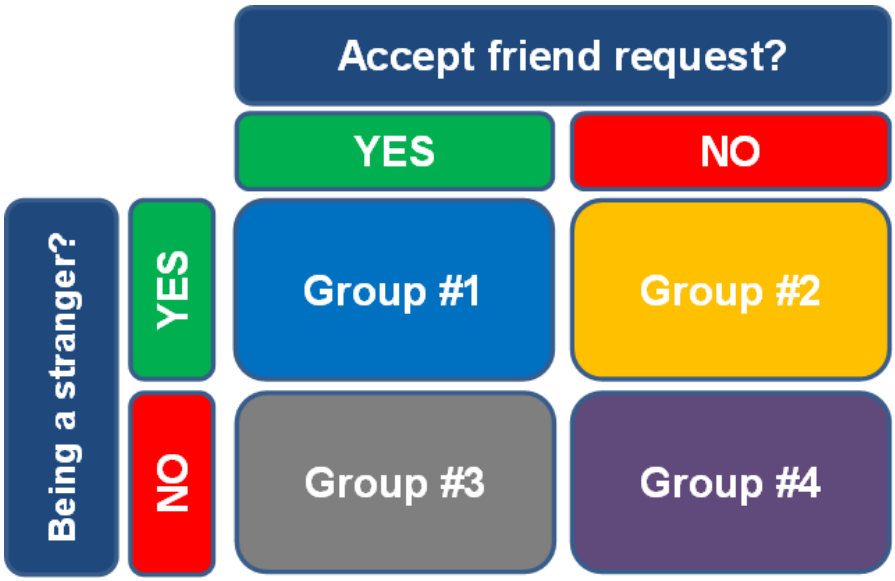

Figure 5.10: Four groups discussed in the analyses.

Group #1 (G1): In this group, users could accept a friend request from strangers. This group is highly of our interest as it is interesting for us to know that what would be friendship factors dominantly employed by users.

Group #2 (G2): The second group is the situation that users would reject friend request from strangers. Although the group itself might not be far from expectation, the comparison of this to other groups, in particular group #1, would be interesting and reveal useful findings.

Group #3 (G3): The third group is when participants would accept friend requests from non-stranger (i.e., know people in real life). Similar to the group #2, although this group itself might not result in unexpected results and observations, we are more interested in finding significant differences when it is compared to other groups.

Group #4 (G4): The last group is the case that users reject friend requests from non-strangers. This group could reveal important information regarding employment of friendship factors. Moreover, it could be interesting to compare the results from this group to group #2 in the sense that what differences are between intuitions behind rejecting strangers and non-strangers.

For the purpose of statistical analysis and comparison between the groups, we used Mann-Whitney'S U test [49], which is a non-parametric version of t test. This test is useful when dependent variable is ordinal. The point of a Mann-WWhitney's U test is that it treats the data as ordinal data. Therefore, we can order the data but the difference between any of the two values is not consistent. What a Mann-Whitney U test does is to calculate the rank for each value instead of using the values as is. As the null hypotheses, no difference in the ranks between each two groups was expected in terms of employment of friendship factors. The following part includes results and discussion from statistical analyses and comparisons performed on the four groups.

Group #1 versus Group #2: As mentioned before, regarding our interest in focusing on users behavior towards strangers' requests, we aimed to compare behavior of participants who already reported to have strangers on their friend list (i.e., group #1) to those who did not (i.e., group #2). First, we found that 62% of users reported to have at least one stranger among their Facebook friends. As the result, we divided our data-set into two parts labeled as G1 (group #1) and G2 (group #2). This was done by analyzing the answers to one of the survey questions, which explicitly asked participants if they have any strangers (at least one) among their Facebook friends. We did not impose any definition for a stranger and participants answered based on their own definition. Then, we compared the results

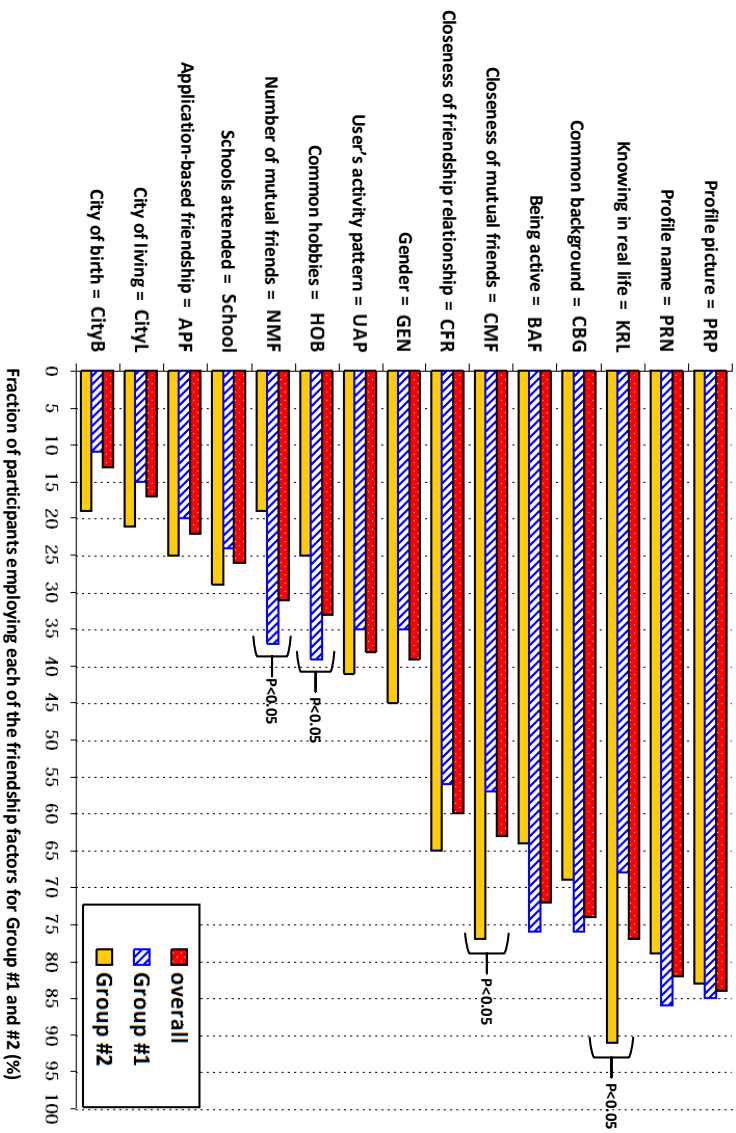

Figure 5.11: Comparison of friendship factors employment between G1 and G2.

corresponding to each of the friendship factors to investigate similarities and differences. In the following, we describe the results of our comparison for each of the factors (Figure 5.11).

We found that while only 68% of participants in G1 consider the knowledge of the requester in real life (KRL) in their decision process, this number jumps to 91% for G2, with the difference being statistically significant (Mann-Whitney's test: $p = 0.0003 < 0.05$). We interpret this result as an indicator for the level of awareness in these two groups.

For profile name (PRN), although we did not see much difference between the groups, participants in G1 reported more interest than those in G2 (80% vs 87%) for using profile name as a factor.

For common background, we looked at four types of background information, including city of birth (CityB), city of Living (CityL), schools/universities attended (School), and common hobbies/interests (HOB). For the first three factors, we could not find statistically significant difference between participants in G1 and G2. However, G2 participants were slightly more interested in them (CityB: 19% vs 12%, CityL: 21% vs 15%, School: 29% vs 25%). The difference was significant when it came to "common hobbies/interests" (HOB). While 40% of participants from G1 employed this as a friendship factor, there were only 25% in G2 who did so (Mann-Whitney's test: $p = 0.03 < 0.05$). This result could be leveraged as a cue by socialbots to customize profile information in order to increase the chance of getting their friend requests accepted. "Being active" (BAF) was also more popular among G1 (76%) members rather than G2 members (64%), although the difference was not statistically significant.

Regarding the "number of mutual friends" (NMF), we saw significantly more

members in G1 (37%) than G2 (19%) employing it as a factor in their decisions (Mann-Whitney's test: $p = 0.01 < 0.05$). Also, comparison of G1 and G2 in terms of "closeness of mutual friends" (CMF) indicated that more participants in G2 (77%) cared about it than in G1 (57%) (Mann-Whitney's test: $p = 0.03 < 0.05$). The results of comparison for NMF and CMF suggest that informing users about the closeness of the requester with the mutual friends would be more effective than only showing the number of such friends (available in current interface).

For user's activity pattern, we found that participants from G2 were slightly more interested in UAP than from G1. We suspect that the absence of statistically significant results in regards to UAP is due to the difficulty of finding a pattern, as we had this feedback in exploratory study. Regarding closeness of friendship relationship, we did not find statistically significant difference between G1 and G2. This result is expected, as it more relates to groups in which friendship requests are sent from known users, according to our interview data. Finally, we could not find statistically significant difference between participants in G1 (20%) and G2 (25%) regarding application-based friendship (APF), although we expected to observe significantly more participants in G1 who rely on this factor. This might be because of the shortage in the number of participants who have received this type of friendship requests.

Group #1 versus Group #3: Similar to the previous section, we performed comparison between group #1 and group #3 in order to understand possible differences between users' behavior in these two groups. For G3, we considered participants who tend to be friend on Facebook with people they know in real life regardless of their behavior on Facebook. In the following, we describe the results of our comparison for each of the factors (Figure 5.12).

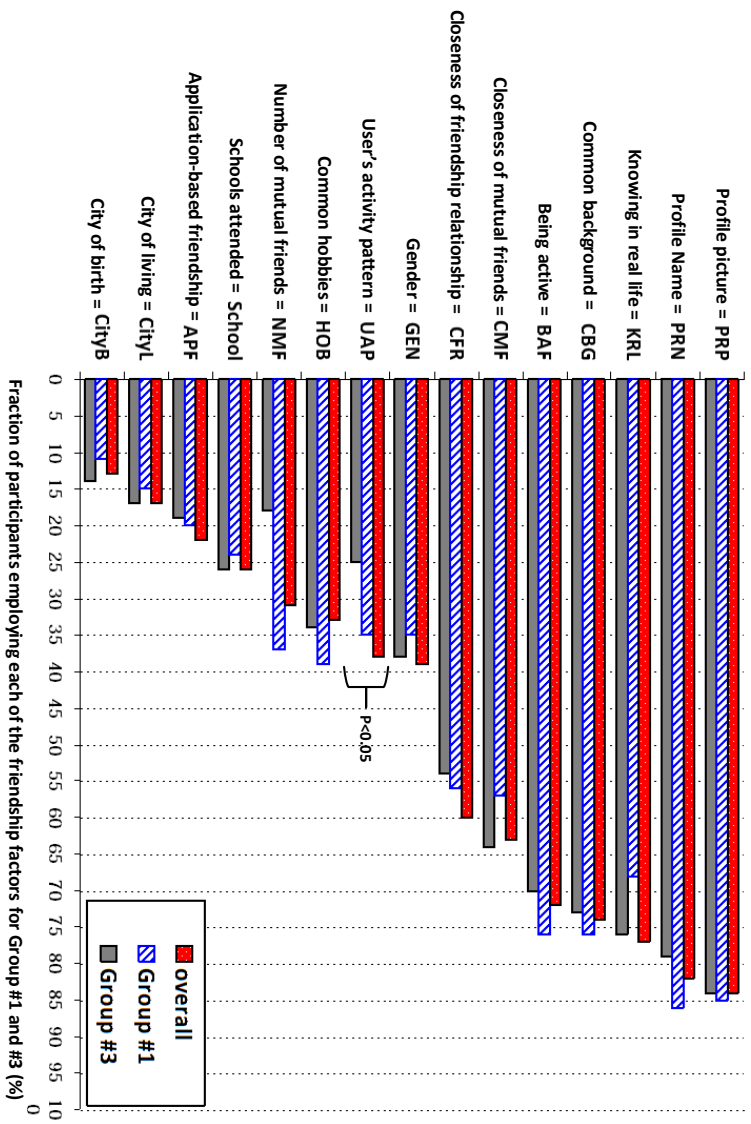

Figure 5.12: Comparison of friendship factors employment between G1 and G3.

Among the friendship factors, we found significant difference between these two groups only in UAP (i.e., user's activity pattern)(Mann-Whitney's test: p = $0.008 < 0.05$). As the results show, users in G1 are more interested in the activity pattern. We interpret this difference as an indicator that shows in G1 users are more interested to have connection with people who have activities close to their preferences. There are also other observations that are insightful although they are not statistically significant. For instance, NMF and HOB seem to be more important in G1 rather than G3. Expectantly, KRL and CMF were employed more in G3 as the group itself is happened when a request is accepted from a known person.

Group #1 versus Group #4: From comparison of group #1 and group #4 (Figure 5.13), we found three factors to be employed significantly different in these two groups. The analysis indicates that "School" factor (i.e., having attended common schools/universities) is more employed in G1 (Mann-Whitney's test: p = $0.005 < 0.05$). This actually makes sense as in G4 users are not easygoing even with people they know in real life. The next friendship factor is UAP that has significant difference in terms of employment by users in G1 and G4 (Mann-Whitney's test: p = 1.005e-07 < 0.05). According to the analysis, 67% of participants who reported to have experience in G4 believed that user's activity pattern is important. On the other hand, only 34% in G1 reported UAP as a factor taken into consideration. This result also makes sense as it means that users in G4 care much more about activity pattern. The next factor that analysis shows significant difference is CFR (Mann-Whitney's test: p = $0.002 < 0.05$). While 78% in G4 believe that closeness of friendship in real life is an important factor to be considered, 55% has the same opinion in G1. This could be interpreted by the fact that G1 is happened when a

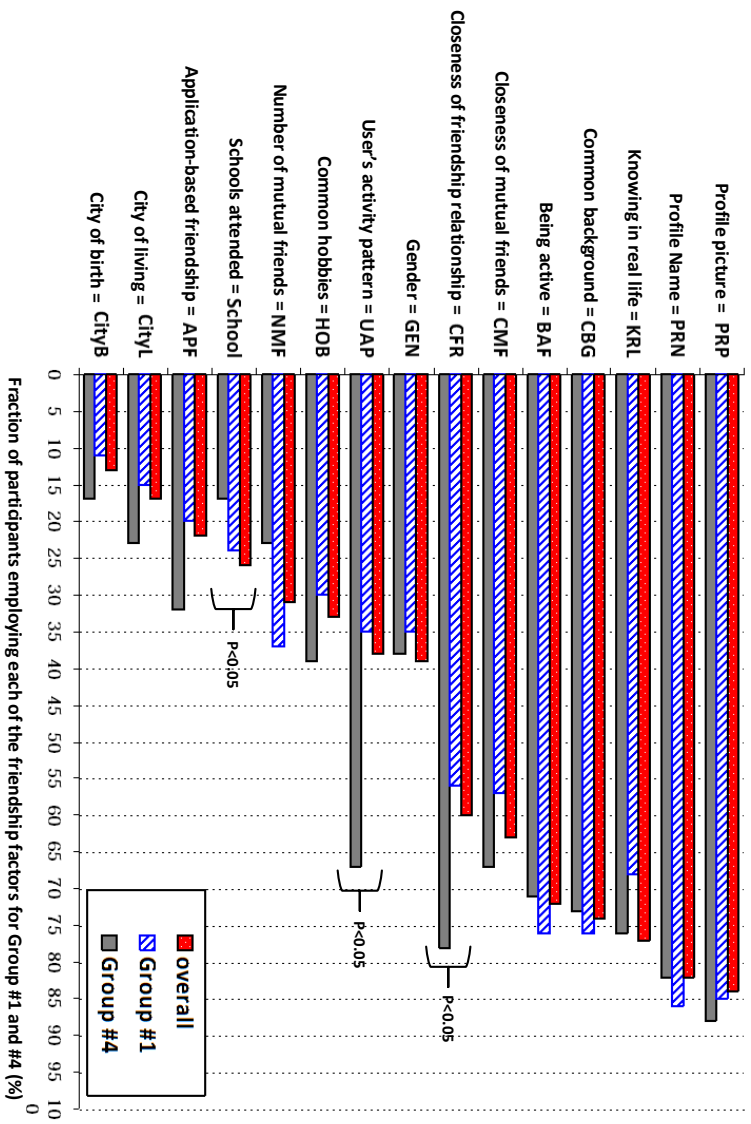

Figure 5.13: Comparison of friendship factors employment between G1 and G4.

stranger's request is accepted. We also found that NMF is employed more in G1 rather than G4 although there is no significant difference reported by the analysis.

Group #2 versus Group #3: According to the analysis (Figure 5.14), there are four friendship factors that are differently employed by users in G2 and G3. Starting from the first one, CMF is reported more to be used in G2 with 77% while 64% is reported in G3 (Mann-Whitney's test: p = 0.04 $<$ 0.05). KRL has a similar story with 91% in G2 versus 76% in G3 (Mann-Whitney's test: p = 0.01 $<$ 0.05). We also found that activity pattern (UAP) is more popular in G2 (41% versus 25%) rather than G3 (Mann-Whitney's test: p = 0.0001 $<$ 0.05). CFR is the last factor with significant differences in G2 and G3. We found that CFR is also more employed in G2 in comparison to G3 (Mann-Whitney's test: p = 0.05 $<=$ 0.05). Reviewing the aforementioned factors, we can observe that factors, which help users recognize users' identities are paid more attention in G2. We also found that HOB and NMF are more popular factors in G3 while the difference is not statistically significant.

Group #2 versus Group #4: Analysis of G2 and G4 results in finding four friendship factors that are differently employed in these two groups (Figure 5.15). CMF was reported by 77% who had experienced G2 and by 67% in G4 (Mann-Whitney's test: p = 0.04 $<$ 0.05). For KRL, the story was almost the same as 91% reported to consider it in G2 versus 76% in G4. Both show that making sure that requester is known has higher importance in G2 rather than G4. However, results about CFR reveals another interesting point. By comparing the fractions related to CFR, it shows that CFR is paid more attention in G4 (78%) than G2 (64%)(Mann-Whitney's test: p = 0.05 $<=$ 0.05). This could be interpreted such that users in G4 care more about the quality of friendship in real life rather than only investigating

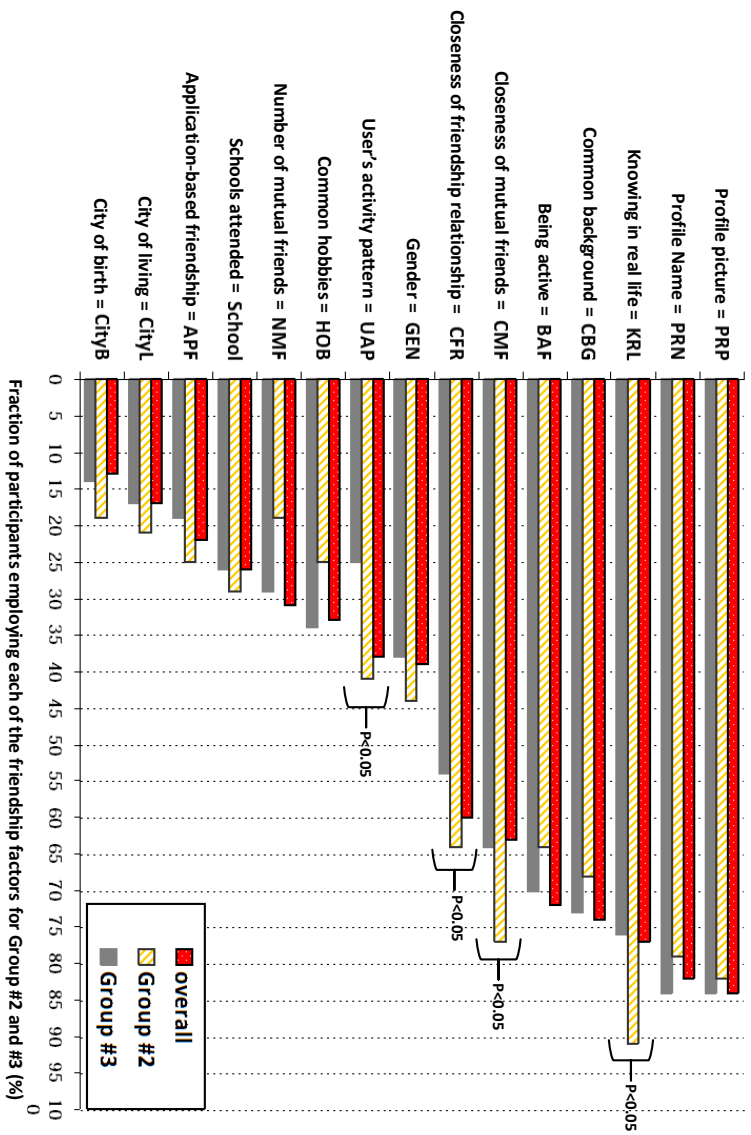

Figure 5.14: Comparison of friendship factors employment between G2 and G3.

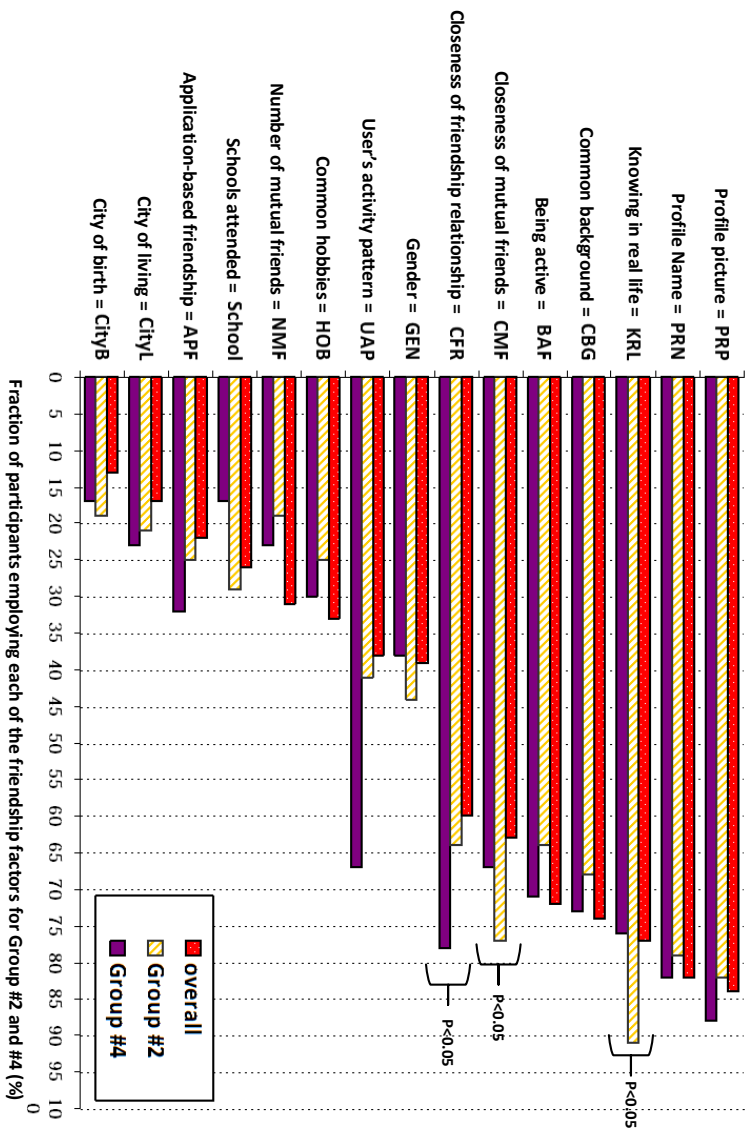

Figure 5.15: Comparison of friendship factors employment between G2 and G4.

about knowing people in real life. In addition, we found UAP to be given more value in G4 rather than G2, which is aligned with our expectation considering the definition of groups.

Group #3 versus Group #4: There are three friendship factors that are differently employed by users in G3 and G4. Regarding our analysis, "School" factor is more popular in G3 rather than G4 while UAP and CFR are more employed in G3 in comparison to G4. Interpreting the results is similar to the previous section as users in G4 are more interested to have connection with people who are close to them and also have acceptable behaviors in their point of view. On the other hand, being friend with people who are know in real life is appreciated and as the result popularity of "School" factor in G3 could be an example of that.

We discuss these results as cues to propose our suggestions for interface design improvements in the next section.

5.5 Discussion

Considering the first goal defined for the survey, we analyzed the data related to each of the factors to investigate how much they are used. As the result, except for UAP and APF, all other friendship factors were employed by at least more than 50% of participants, which shows the validity of friendship factors inferred from the exploratory study. In addition, we asked survey participants to share with us other friendship factors if they have any. Analysis of answers to this question did not add to the factors themselves. The participants who answered this question, mostly suggested features that could be added to the friend request decision dialogues. As mentioned earlier, since having access to user's wall is usually not possible, people may not consider UAP as a friendship factor that could be eas-

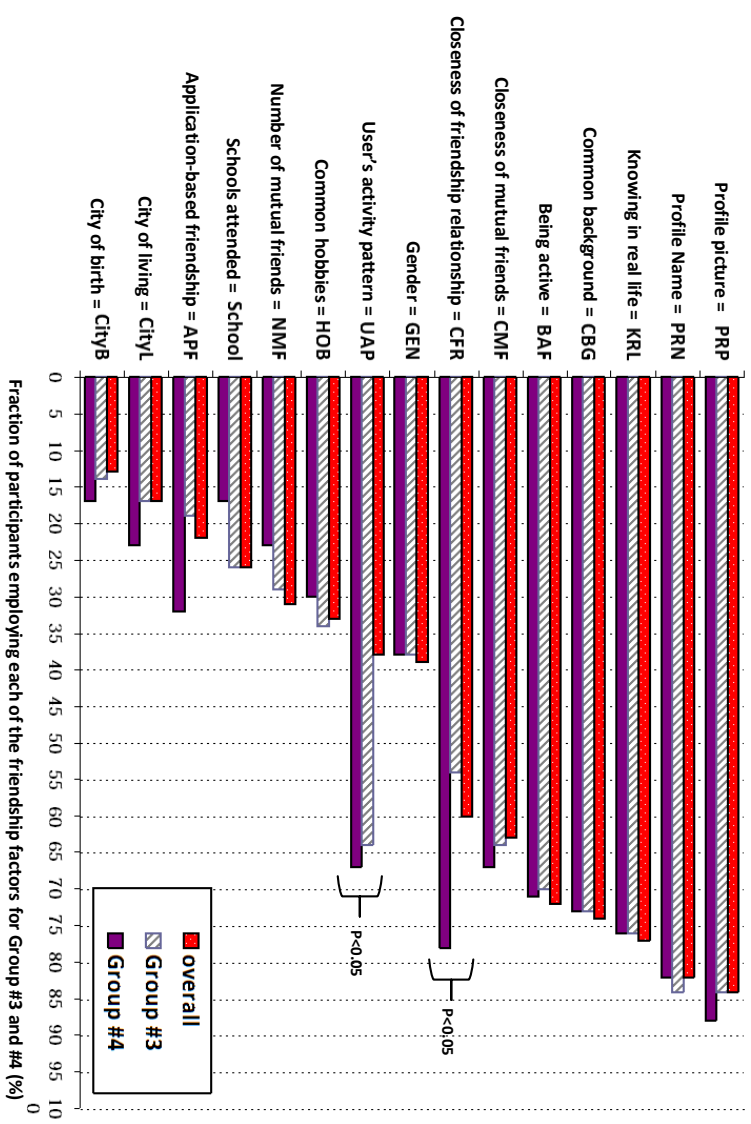

Figure 5.16: Comparison of friendship factors employment between G3 and G4.

ily investigated although they are interested in it. However, according to the exploratory study, participants prefer to have information about the activity patterns of requesters. For APF, a low percentage was expected from the interview study, in which only few participants reported receiving friendship requests from applications.

For the second goal, the idea of focusing on four different groups and performing statistical analysis and comparison helped us to uncover the impact of the friendship factors. As the results show, we found a set of friendship factors that could play a notable role and affect user's decision towards friend requests. As previously mentioned, our findings show that in G2 and G4 that are groups in which users reject friend requests from strangers and known people, four factors including CMF, KRL, UAP, and CFR are paid more attention and users care more about them while NMF, HOB and School are significantly less employed. By reviewing these factors, it is implied that privacy and quality of relationship are taken into consideration. For instance, closeness of mutual friend is more important than number of mutual friend. Also knowing in real life or closeness of friendship in real life as well as activity pattern could be interpreted as an indicator for quality of a relationship. By focusing more on these groups, we can also find out some differences between G2 and G4. In this regard, analysis show that CMF and KRL are more employed in G2 as they are more about investigating the identity of requester. On the other hand we found that CFR is more used in G4 as it helps to make sure Facebook friends are of those that are close friends in real life as well. This result could be leveraged for improving the interface design so that user makes more informed decision.

Chapter 6

Discussion

In this thesis, we aimed for a better understanding of user's befriending behavior in FOSNs, and also what makes them to accept or decline friendship requests. This is an important problem as accepting friend requests from strangers is still known to be a vulnerable behavior. Our work contributes to provide socio-technical solutions to help FOSN users be aware of their decisions towards friendship requests sent from strangers. We performed two studies in order to tackle our research problem.

First, we conducted interviews with 20 active Facebook users to better understand user' behavior for making decision about friend requests. According to our analysis, we showed there are three factors that impact users decisions including internal factors (Friendship Factors, Privacy/Security Awareness and Concern), external factors (Environmental Factors, Interface Capabilities) as well as a 3-step process of decision making (investigation, decision execution, maintenance). We believe that this model is helpful to improve part of interface related to scenario of receiving friendship requests. Having this model, it is possible to understand the process of friend request acceptance and improve the interface design. This

model also helps us to answer our research questions (factors and actions taken by Facebook users) as it introduces the friendship factors employed by FOSN users. Moreover, it gives insight to find out what are the pre-actions and post-actions that are taken by users before and after the decision making process about friend requests.

Second, we aimed to find possible factors that have a role in users' decisions about friendship requests in order to address our research question, which was to characterize users' behavior when it comes to decide about a friend request. Therefore, we tested the friendship factors revealed by the exploratory study and measured the fraction of users who employed those factors. Then, we considered four different groups in which users are situated when they receive friend requests. We characterized users behavior in these groups by performing statistical analysis and comparing employment of friendship factors in each group. Characterizing the users behavior helped us to find key factors that influence users to take a decision about a friend request. It also allowed us to collect quantitative data from a representative sample (397 participants using Amazon Mechanical Turk). According to our results, accepting stranger's request is still a threat as having a stranger in friend list was reported by 62% of our participants. We also found interesting results from the analysis of the groups. We introduced 4 friendship factors (Knowing in the real world, common hobbies/interests, number of mutual friends, closeness of mutual friends) that can significantly impact users' decision towards stranger's request. We also found friendship factors that are employed significantly different in the groups based on our pairwise comparison of the groups. Also, our results show that majority of the factors that are employed significantly by users are not currently available in the interface design of FOSNs (e.g., User's activity pattern,

Closeness of friendship relationship, Closeness of mutual friends). Therefore, the interface design could be improved by providing features that include these friendship factors.

As the third part, we proposed 4 guidelines to improve the interface such that users can make more informed decisions when they receive friendship requests from strangers.

Interface Design Recommendations: As discussed before, the results from the analysis of our survey data revealed interesting points about friendship factors that could be used for improving the Facebook interface. Therefore, we offer the following suggestions for designing user interfaces for accepting friendship requests:

- The interface should convey the importance of making accurate decisions about friendship requests and encourage users to make informed decisions. For instance, users could be notified by a pop-up window (similar to current design) asking users to go to another page in order to make an informed decision, using useful information or a check list. Having such a feature in the interface is supported by the OLFFA model since it helps users to appreciate the importance of these decisions.

- The interface could contain a message box so that requesters can briefly specify how they know the user. Another suggestion is to give access to photos selected by each user to better recognize the requester. We had reports from participants of both studies complaining about unclear small photos. This kind of improvement would facilitate the investigation/maintenance actions (in the decision making process of OLFFA model) for users.

- It could be helpful if user had access to statistics (number of likes, number of comments, number of personal messages, number of common photos) about interaction with his/her friends. In this case, it is easier to investigate closeness of mutual friends, which was shown to be more useful than only the number of mutual friends. In other words, this feature would facilitate the Investigation Actions in the OLFFA model for finding out closeness of mutual friends.

- The interface could encourage the user to specify the access level for new friends at the time the user accepts a friend request. We suggest this because our analysis showed that 31% of participants in S1 did not define any access level for their friends while 9% in S2 reported similar behavior. Therefore, this could be helpful (at least for users who accept stranger's requests) as a facilitator for performing maintenance actions and help users to be more cautious about the level of access they grant to their Facebook friends. Alternatively, it could be helpful to suggest different friend types such as acquaintances, co-workers, close friends to users when they accept a new friend request.

It is worth mentioning that although we believe these recommendations could be helpful for the Facebook interface improvement, they are currently hypotheses to be tested.

As previously mentioned, offering these recommendations is motivated by our research question and the goal to prevent or at least limit the security implications of large-scale infiltration attacks shown by previous work. These recommendations could be helpful to improve the part of the interface related to receiving friend

requests.

6.1 Future work

There are several directions for future work. One direction could be to focus on each component of the model (external and internal factors) and investigate potential impact of them on deciding about stranger's request. Another direction is to perform structural model testing on the proposed model Structural Equation Modeling (SEM) to test the significance of impact of model components on each other. Although the model is already verified by the Grounded Theory, it could be interesting to figure out how significant is the relations between each of the components. Finally, another direction is to conduct a user study and investigate impact of modifying the interface using the proposed recommendations. It could be done by running user studies on controlled groups . For instance, one group can be asked to use the real Facebook interface and the other group can be asked to use a system, which has already the prototype installed on it. Then, these groups could be compared in terms of performance criteria, which is the rate of request acceptance from strangers. It could be also interesting to perform evaluation by comparing the results to other solutions such as fake account prediction algorithms.

6.2 Limitations

Our work has several limitations. In the exploratory part, it would be better to have more diversity in terms of age so that the model could be representative of a wider range of Facebook users. On the other hand, although we reach saturation in data collection, we had five participants who accepted friendship requests from the volunteer. Having more participants from this group could result in more interesting

observations and a more accurate model as it could include cultural aspect of users' behavior. Another limitation that might exist in our study is the Hawthorne effect [4]. However, as we used a qualitative technique in this study (semi-structured interviews), we tried to elicit the participants' thinking during the study. Also, according to previous work [47], the Hawthorne effect, as it is usually understood, is nothing more than a popular myth that should not be assumed as a reliable basis to question the validity of any experimental study. Also, the Hawthorne effect is very controversial and there are different interpretations for this effect and it is not necessary valid and safe to criticize based on this effect [47].

In the survey, we asked participants to report their activities, which might include some inaccuracies similar to all self-report studies. As an alternative, it could be done by providing them with different scenarios and then asking them questions. We refrained from doing this due to the time limits of our survey. Also, our sample is not representative of all Facebook users, as we recruited participants only from USA and Canada. Having participants from other countries could reveal more interesting points about users befriending behavior. Moreover, we did not focus on gender differences in our study design, which has been shown to be important by previous work [1] as men and women have different social media activities and different reasons for making their connections in social media including online social networks (Facebook in particular). Also, while we briefly discussed the observations in which participants reported the behavior transfer from their experience in other social networks such as LinkedIn to Facebook (e.g., in terms of security awareness) in the exploratory results, we could deeply focus on behavior of participants on other social networks such as Flickr, LinkedIn, tumblr, Twitter, and Google+. We could also consider personal social behavior of participants in the

real word by capturing information about personal rating of shyness, introversion and extroversion, and number of friends they have in the outside world.

Chapter 7

Conclusion

Our work contributes to provide socio-technical solutions to help them be aware of their decisions towards friendship requests sent from strangers. First, we aimed to better understand their behaviors by conducting an exploratory study. According to analysis of interviews, we developed a model, which we call Online Lifecycle of Facebook Friend Acceptance (OLFFA). In this model, we showed that there are three factors that impact users decisions including internal factors (Friendship Factors, Privacy/Security Awareness and Concern), external factors (Environmental Factors, Interface Capabilities) as well as a 3-step process of decision making (investigation, decision execution, maintenance). We believe that this model is helpful to improve part of interface related to scenario of receiving friendship requests as users' behavior could be interpreted by this model. We also showed that accepting stranger's request is still a threat as having at least one stranger in friend list was reported by 62% of our participants. As the second step, we chose to have another study, which was a survey on Amazon Mechanical Turk. We wanted to test the friendship factors revealed from the exploratory study. Moreover, we focused on

different situations that FOSN users may face when they receive friend requests. Therefore, we considered four groups including acceptance of strangers, rejection of strangers, acceptance of known users, and rejection of know users. We statistically analyzed the differences between employment of friendship factors using pairwise comparisons between the aforementioned groups. Results reveal different friendship factors that are employed significantly more in each of the groups. The interesting finding about the results is that majority of friendship factors that were dominantly employed (specially for identifying requesters) are not currently provided by the Facebook interface. For instance, User's activity pattern, Closeness of friendship relationship, Closeness of mutual friends are not currently available for Facebook users while these are desired by users who want to make sure about the identity of requesters or make sure about the requester's activity pattern. Regarding our interest in finding the reason(s) behind acceptance of strangers from FOSN users (i.e. group #1), we focused on the results of from the comparison of group #1 and group #2. We also introduced 4 friendship factors (Knowing in the real world, common hobbies/interests, number of mutual friends, closeness of mutual friends) that can significantly impact users' decision towards stranger's request. Then we leveraged these results in order to come up with interface design recommendations that could be used to improve the interface design such that users can make informed decisions towards requests sent from strangers.

To summarize, this work has the following contributions:

1. We developed a model for online lifecycle of Facebook friendship acceptance, which explains the factors that influence users' behavior in response to friend requests.

2. We characterized such factors and analyzed their impact on users' decision with regards to friend requests. We also identified four factors that significantly impact users' befriending decisions.

3. Based on both qualitative and quantitative results, we suggest design guidelines for FOSN interfaces that we expect can help users make informed decisions about friend requests.

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Appendix A

Interview Materials

All the documents related to the exploratory study are attached in this section.

1. INTERVIEW

Note: At the beginning of the interview, we will not inform the interviewees the potential threats of accepting a stranger's friendship request in Facebook.
Objectives: Collect interviewees' responses to investigate users' behaviors towards friendship requests sent from users and strangers in particular.
Sample: Active users on Facebook (login to account at least once a week). Data collection should be done till we reach the theoretical saturation.

Agenda:

1. Give an overview of the project: "The purpose of the study is to investigate the factors users employ when making a decision to befriend other users."
2. Introduce second interviewer and specify his role.

Part1:

A. EXPLORATORY STUDY DOCUMENTS—INTERVIEW

A.1 General Questions:

a. What is your age?
b. What is your gender?
c. What is your highest level of education?
d. What is your major or occupation?
e. How long have you own a Facebook account?
f. How often do you use Facebook?
g. What is your first language?

A.2 The befriending behavior of users with strangers:

a. How many friends do you have on Facebook?
b. How often do you receive friend requests?
c. Have you ever accepted a friendship request from a stranger you do not know in real-life or have not met before online or offline?
d. What kind of factors do you rely on when you decide to accept a friendship request from a stranger? (For any factor users ask, we need to dig into more details by asking questions)
   (Gender, Friends, Mutual Friends, Profile, Picture, Wall—show the activity in Facebook)
   i) **(The interviewee mentioned gender.)** Will you accept a friendship request from a homosexual stranger or a heterosexual one?
   ii) **(The interviewee mentioned friends.)** How many friends does the stranger have that you will accept his/her friendship request?
   iii) **(The interviewee mentioned mutual friends.)** How many mutual friends does the stranger have that you will accept his/her friendship request?
   iv) **(The interviewee mentioned profile.)**
   Same/different hometown
   Same/different schools

Same/different age

v) **(The interviewee mentioned wall.)**
Active/quiet person

A.3 Users' attitudes towards their privacy security:

a. Have you ever set your privacy setting?
   i) **(If yes)** How did you modify your privacy setting?
b. Have you assigned different privacy setting to your friends?
   i) **(If yes)** How did you modify your privacy setting for different friends?
c. Have you had reported any security incident before in your online activities on Facebook, email, etc.?
d. Have you realized that if you accept a friendship request from a stranger, he/she will have the access to your personal information?
   i) **(If yes)** What kind of information do you think will be exposed to the strangers?
e. Do you mind your private data being exposed to the strangers?
   i) **(If yes)** What kind of information do you mind being accessed to the strangers?

A.4 Users' appeal of strangers:

a. How do you describe your connection with the stranger that you have accepted his/her friendship request?
b. Are you emotionally attached with the strangers?

3. At the very end, do mention that the request will be removed.

Debriefing happens here!

Part 2:

B.1: What would be your suggestion if you want to design the window for friendship requests?
B.2: Will you change your behavior towards friendship requests? (If participant had accepted the request)
B.3: Do you have anything else related to this study that you want to share with us?

The University of British Columbia

Electrical and Computer Engineering

Understanding Users' Befriending Behavior In Online Social Networks

The Electrical and Computer Engineer department at the University of British Columbia invites participants for a study on "users' befriending behavior in online social networks". Each participants will receive 25$ for their participation.

We require volunteers to participate in one-hour interview session. We will ask questions related to their occasional befriending behavior, and the factors they use when deciding to accept a friendship request. Participants requires the following criteria:

1. **Being active Facebook user, which means checking the profile for at least once a week.**
2. **Having the ability to speak English**
3. **At least 19 years old**

If you would like to participate in this study, please login to Facebook and send a personal message that includes your email address to this user profile:

http://www.facebook.com/user_profile_name

THE UNIVERSITY OF BRITISH COLUMBIA

Electrical and Computer Engineering

Consent Form for a User Study

Principal Investigator:

The principal investigator of this research is Dr. Konstantin Beznosov from the Department of Electrical and Computer Engineering (ECE) at the University of British Columbia (UBC). You can contact him at beznosov@ece.ubc.ca or (604) 822-9181

Co-Investigators:

Yazan Boshmaf, Ph.D. Candidate
Hootan Rashtian, M.A.Sc Student

All co-investigators are from the ECE department at UBC. You can contact them at (604) 827-3410

Purpose:

The purpose of the study is to investigate the behavior of Facebook users. We aim to investigate the factors users employ when making a decision to befriend other users. We also aim to understand how users manage the sharing of their data with their new friends.

Study Procedures:

You will be interviewed about your befriending behavior in Facebook. We will ask you questions about the factors and cues you employ to decide whether to accept a friendship request, and the techniques you use to mange your new friendship. The whole session will be approximately one hour long and is audio-recorded. You will be observed during the session by one co-investigator.

Confidentiality:

The identities of all participants will remain anonymous and will be kept confidential. Identifiable data and audiotapes will be stored securely in a locked cabinet or in a password protected computer account.

Contact for information about the study:

If you have any questions or require further information about the project you may contact Prof. Konstantin Beznosov at (604) 822-9181, Hootan Rashtian at (778) 834-4327.

Contact for concerns about the rights of research subjects:

If you have any concerns about your treatment or right as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at (604) 822-8598 or if long distance e-mail rsil@ors.ubc.ca.

Consent:

Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time. Note that you should be at least 19 years old in order to participation. There is also a $25 award of honorarium as appreciation of your participation.

Your signature below indicates that you have received a copy of this consent form for your own records and indicates that you consent to participate in this study.

_____

Participant Signature Date

_____

Printed Name of the Participant Signing Above

_____

Researcher Signature Date

_____

Printed Name of the Researcher Signing Above

Mediator Confidentiality Agreement

I, _____, student of _____ with ID _____ enrolled in program _____ at University of British Columbia, agree that my employment by Dr. Konstantin Beznosov shall be strictly on the following terms and conditions:

1. I acknowledge that I have completed the TCPS tutorial.
2. I acknowledge that I have been advised that all information and documents that I may have knowledge of or access to through my employment about the Facebook befriending study are strictly confidential.
3. I undertake and agree at all times to treat as confidential all information acquired through my employment with Facebook befriending study including email addresses, Facebook IDs, etc., and not to disclose for any purpose. I acknowledge that such information is not to be altered, copied, interfered with or destroyed, except upon authorization from principal investigator of the study. I will not discuss such information with any party, nor will I participate in or permit the release, publication or disclosure of such information, nor will I copy, distribute, or disseminate such information, except as authorized in the course of my employment or by law. I understand that this agreement and undertaking includes:

a. Never discussing the personality of a participants, his or her file or any details about them;

b. Avoiding the use of names of participants in conversations with other clients, friends or relatives;

c. Ensuring that disclosures of information are made only to persons entitled to that information;

SIGNED at _____, British Columbia, this _____ day of _____, 2013.

_____ _____

Signature Witness

Volunteer Confidentiality Agreement

I, _____, student of _____ with ID _____ enrolled in program _____ at University of British Columbia, agree that my employment by Dr. Konstantin Beznosov shall be strictly on the following terms and conditions:

1. I acknowledge that I have completed the TCPS tutorial.
2. I acknowledge that I have been advised that all information and documents that I may have knowledge of or access to through my employment about the Facebook befriending study are strictly confidential.
3. I undertake and agree at all times to treat as confidential all information acquired through my employment with Facebook befriending study including email addresses, Facebook IDs, etc., and not to disclose for any purpose. I acknowledge that such information is not to be altered, copied, interfered with or destroyed, except upon authorization from principal investigator of the study. I will not discuss such information with any party, nor will I participate in or permit the release, publication or disclosure of such information, nor will I copy, distribute, or disseminate such information, except as authorized in the course of my employment or by law. I understand that this agreement and undertaking includes:

a. Never discussing the personality of a participants, his or her file or any details about them;

b. Avoiding the use of names of participants in conversations with other clients, friends or relatives;

c. Ensuring that disclosures of information are made only to persons entitled to that information;

SIGNED at _____, British Columbia, this _____ day of _____, 2013.

_____ _____

Signature Witness

Debriefing

Our main objective during this study was to understand why users of online social networks, such as Facebook, befriend stranger. To improve the quality one of the team member sent you a friendship request that you have accepted. We inform you that after this study you are free to defriend our team member.

Note, that we have not collected any of your private information that you are not aware of. The friendship request was sent to you so that we can be more specific with questions about your online practices.

Thank you,

OSN Befriending Study Team

Appendix B

Survey Questions

Thanks a lot for participating in this survey. In this survey, there are questions about your activities on Facebook. It will take you about 15 to 20 minutes to answer the questions. For the likert-scale questions, please choose one number from 1 to 5, where 1 means “strongly disagree” and 5 means “strongly agree”.

1. What is your age?

    - 19 to 25
    - 26 to 30
    - 31 to 35
    - 36 to 40
    - 41 to 45
    - 46 to 50
    - 50 to 55
    - 56 to 60

- 61 to 65
- 61 and more

2. What is your gender?

    - Female
    - Male

3. What is your highest level of education completed?

    - High school
    - Undergraduate
    - M.Sc
    - PhD
    - Other:

4. What is your employment status?

    - Employed
    - Student
    - Retired
    - Unemployed
    - Other:

5. How long have you owned a Facebook account?

    - Less than a year
    - 1 to 2 years

- 2 to 3 years
- 3 to 4 years
- 4 to 5 years
- More than 6 years

6. How often do you login into Facebook?

    - Every hour
    - Several times a day
    - Once a day
    - Several times a week
    - Once a week
    - Several times a month
    - Once a month
    - I have my account de-activated
    - Other:

7. Please go to your Facebook profile. How many friends do you have on your Facebook profile?

    - Answer:

8. How often do you receive friendship request?

    - Everyday
    - At least once in 2-3 days

- At least once a week
- At least once a month
- At least once every 6 months
- At least once a year
- At least once in every two week
- Other:

9. Have you ever accepted a friendship request from somebody who you do not know in real life or online communities?

   - Yes
   - No

10. Check all groups that you would likely befriend on Facebook:

    - Parents
    - Siblings
    - Relatives
    - Close friends
    - Friends
    - Acquaintance
    - Colleagues
    - Other:

11. If I distinguish the person from the picture, I would accept the friendship request.

- 1
- 2
- 3
- 4
- 5

12. I usually become friends with:

    - Only females
    - Only males
    - I do not care about the gender

13. Knowing the number of mututal friends is enough for me to accept a friendship request.

    - 1
    - 2
    - 3
    - 4
    - 5

14. If I have mutual friends with the person who sent me a friendship request, I would look at the closeness of those mutual friends to me in addition to just the number of mutual friends.

    - 1
    - 2

- 3
- 4
- 5

15. If I know somebody in real world or online communities, I would accept her/his friendship request on Facebook.

    - 1
    - 2
    - 3
    - 4
    - 5

16. If I recognize someone's name, I would accept her/his friendship requests on Facebook.

    - 1
    - 2
    - 3
    - 4
    - 5

17. ( ) of my friends actively share content on Facebook (1: a few, 5: almost all)

    - 1 (a few)
    - 2
    - 3

- 4
- 5 (almost all)

18. I tend to accept friendship request from everybody, who was born in the s Iame city as I.

    - 1
    - 2
    - 3
    - 4
    - 5

19. I tend to accept friendship request from everybody, who lives in the same city as I do.

    - 1
    - 2
    - 3
    - 4
    - 5

20. I tend to accept friendship request from everybody, who have attended the same school/university as I do.

    - 1
    - 2
    - 3

- 4
- 5

21. Similarity in personal interests or hobbies is sufficient for me to accept friendship requests.

    - 1
    - 2
    - 3
    - 4
    - 5

22. I mostly accept friendship requests from people who share a lot of content on Facebook.

    - 1
    - 2
    - 3
    - 4
    - 5

23. Users who passively monitor others' posts on Facebook does'nt motivate me to post less content on Facebook.

    - 1
    - 2
    - 3

- 4
- 5

24. I limit my activities on Facebook because I know my friends are not interested in the content that I post.

    - 1
    - 2
    - 3
    - 4
    - 5

25. I don't tend to accept friendship requests sent from Facebook applications.

    - 1
    - 2
    - 3
    - 4
    - 5

26. I used to share more content since I felt more comfortable to share content with my Facebook friends.

    - 1
    - 2
    - 3
    - 4

- 5

27. If my friends shared content irrelevant to me, I would remove them from my friends list.

    - 1
    - 2
    - 3
    - 4
    - 5

28. I don't accept a friendship request if I have just common interests or hobbies with the person who sent me friendship request.

    - 1
    - 2
    - 3
    - 4
    - 5

29. I would accept friendship requests sent from a Facebook application (for example a game) on behalf of others.

    - 1
    - 2
    - 3
    - 4

- 5

30. Who is a Facebook user that you do not want to have a friendship connection with on Facebook?

    - Any body who seems to be annoying (sending weird message, irrelevant post, etc.) regardless of being known in real life or not. 308
    - Any body except people that are known to some extent
    - Any body except for those that have strong connections in real life

31. How would you define different levels of access for Facebook friends?

    - Creating separate lists with different access levels
    - Using manual exemption feature for each shared content
    - I do not define different levels of access