

# **Human Centred Design of Software Agent in Social Network Service Against Privacy Concerns**

A thesis submitted for the degree of Doctor of Philosophy

by

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# ABSTRACT

The rapid growth and influence of social network services has led many scholars to focus on privacy issues. However, the research described in this thesis was motivated by the small number of design studies that have focused on practical approaches to identifying tacit information from users' instant non-verbal responses to privacy issues. The research therefore aimed to propose persona models as a design solution for software agent development based on the analysis of users' emotional and behavioural responses, so as to address privacy issues in social network services. In the definition phase, 21 stakeholders belonging to three key stakeholder groups were recruited for unstandardised semi-structured email interviews. Three main considerations for the design of software agents in social network services emerged from the interviews, which were classified into the following categories: comprehensive understanding of users' perceptions of privacy; user type recognition algorithm for software agent development; and existing software agent enhancement. In the development phase, 50 participants were recruited for the Facebook case study, which included three research strategies: perceptions of privacy questionnaire for user typology; emotional response measurement using Geneva Emotion Wheel; and behavioural response observation using a contextual inquiry method. The participants were classified into four user types by means of cluster analysis: uninformed, trustful, suspicious and neglectful. Each user type's key emotional responses were identified using Kruskal-Wallis test and Mann-Whitney  $U$  test, and key behavioural responses using affinity diagrams. This generated persona models of each user type that reflected the correlations between users' perceptions of privacy, key emotional responses and key behavioural responses. Two fundamental features of the software agent were also proposed based on the persona models: confirmation and guidance. In the validation phase, software agent prototypes were created based on the proposed persona models. A total of 206 participants completed the online survey which included two sections: perceptions of privacy questionnaire for user typology replication, and key emotional responses measurement before and after the intervention of the software agent prototypes. Cluster analysis replication validated the proposed user typology, and Wilcoxon signed-rank test of key emotional responses validated the proposed persona models. By implementing the research outcomes, the software agent described in this thesis would be able to provide users with appropriate services based on their user types, to reduce the number of those who are still unaware of privacy practice and those who neglect their accounts, and to expand the size of a user group pursuing sound relationships.

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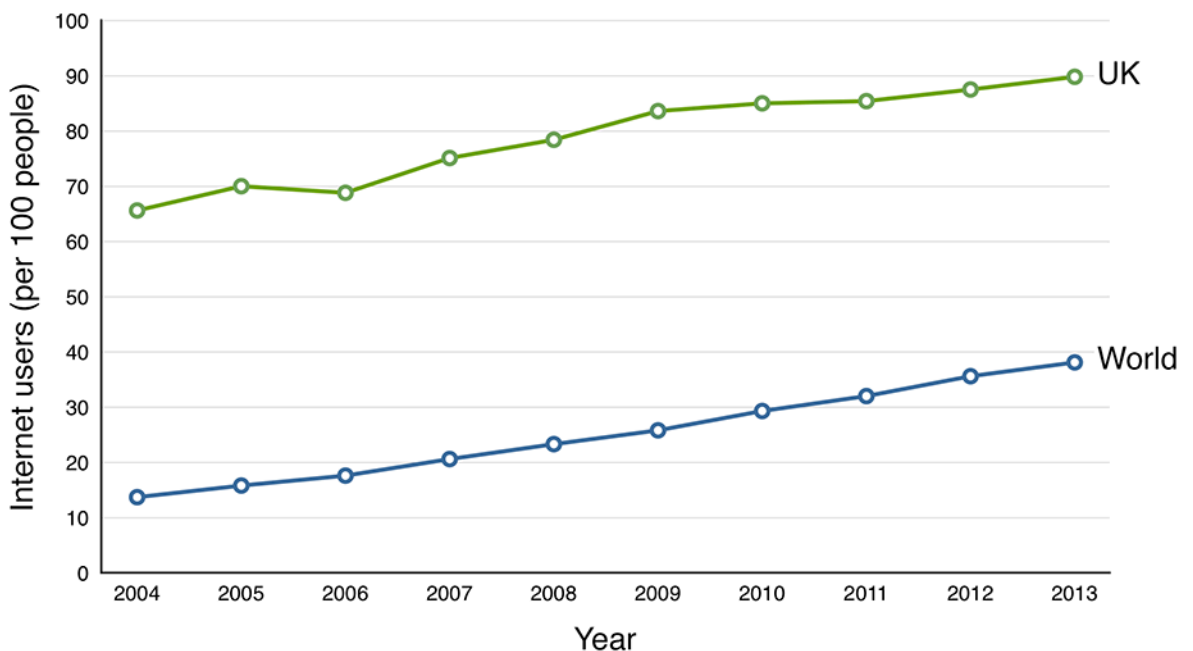
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# Chapter 1. Introduction

## 1.1 Background and Research Gap

### 1.1.1 Some Facts About the Internet and Social Media Usage

Web 2.0, social media, social network services, Facebook, Twitter, Instagram. These are familiar terms to today's internet users. Since the advent of the internet in the early 1960s (Pastor-Satorras and Vespignani, 2004), many people have used it for various purposes such as emailing, searching and retrieving information, sending instant messages, shopping, watching television, listening to the radio, social networking, transferring files, making phone calls, and so on. Some statistical data indicate that the internet has pervaded people's everyday lives and that use is only growing. According to the World Bank Group (2013), internet users worldwide numbered 38.1 (per 100 people) in 2013, compared to 13.7 in 2004. In the UK, 89.9 of 100 people in 2013 used the internet, compared to 65.6 in 2004 (Figure 1.1).



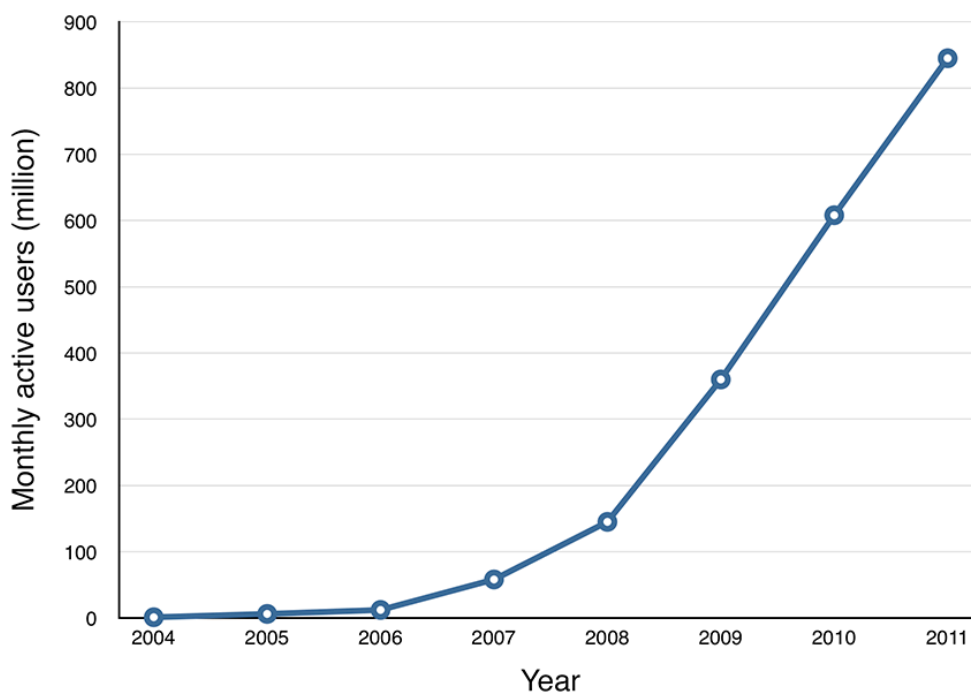
[Figure 1.1] Internet users (per 100 people) worldwide and in the UK (Data Source: World Bank Group, 2013)

Internet usage has grown 188% in the last eight years. The growth rate is relatively higher in developing countries such as China or India. According to the International Telecommunication Union (ITU, 2013), the number of internet users in developing countries grew 175% in five years, compared to only 30% in developed countries. Moreover, a quarter of the world's total internet users in 2013 were Chinese; they represent almost 37% of the internet users from developing countries.



In parallel with user growth all over the world, information storage and streaming have been growing. According to a report by the Task Force of the European Commission's DG Information Society and Media (2009), Google indexed one trillion web pages in 2009 (26 million in 1998). The report also claimed that "there are 400 million web pages and 55 trillion links between these web pages. The web is processing 100 billion clicks per day, two million emails and one million instant messages per second" (Task Force of the European Commission's DG Information Society and Media, 2009). Video traffic has also been growing by 60% every year and is anticipated to be 1000 times its current volume within the next five to eight years.

Some statistical data also explain why the term "social media" has been a buzzword over the last decade. According to the New Age (2011), almost 1.2 billion individuals, or approximately 82% of the worldwide internet population above the age of 15, are active social media users. Among social media outlets, Facebook is currently the most popular service in the world and is the second most trafficked service in the United States (Alexa Internet, 2012). In 2011, Facebook had 845 million monthly active users (Facebook, 2012). If Facebook were a country, it would be the third most populous country in the world (Economist, 2010). These statistics indicate that millions of people are living in cyberspace (Castronova, 2005), a place for interaction as important as people's offline life (Bakardjieva, 2005). Figure 1.2 presents the change in the number of Facebook's monthly active users since its beginning in 2004.



[Figure 1.2] Facebook's monthly active users (in millions) (Data Source: Facebook, 2012)

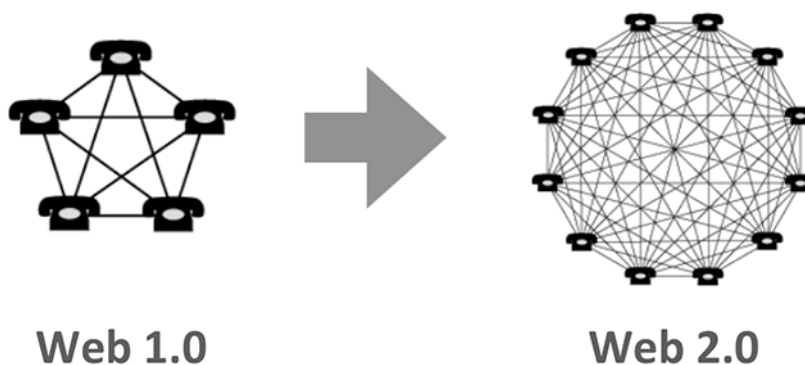
In addition, Customer Insight Group (2012), a customer relationship management consulting company based in the United States, announced that Twitter, another well-

known social media site, has over 200 million accounts and almost 350 million tweets per day. LinkedIn (2012), social media outlet specialising in professional networks, has more than 150 million members in over 200 countries, up from only 4,500 in 2003.

### 1.1.2 Software Agent as a Mediator in Complex Cyberspace

The rapid growth of the Internet has caused complexity issues. As suggested, over one billion people are currently “living” in cyberspace; however, cyberspace is getting more and more complex. Maes (1995a) has argued that cyberspace is already “overwhelming” for individuals, regardless of the interface design quality. Users currently retrieve a massive amount of data from cyberspace; however, the consequential diversity and complexity lead to difficulties, even competent computer users, to productively identify the right or the best information (Bignell, 2005; Ramparany, Ortholand and Louis, 2008).

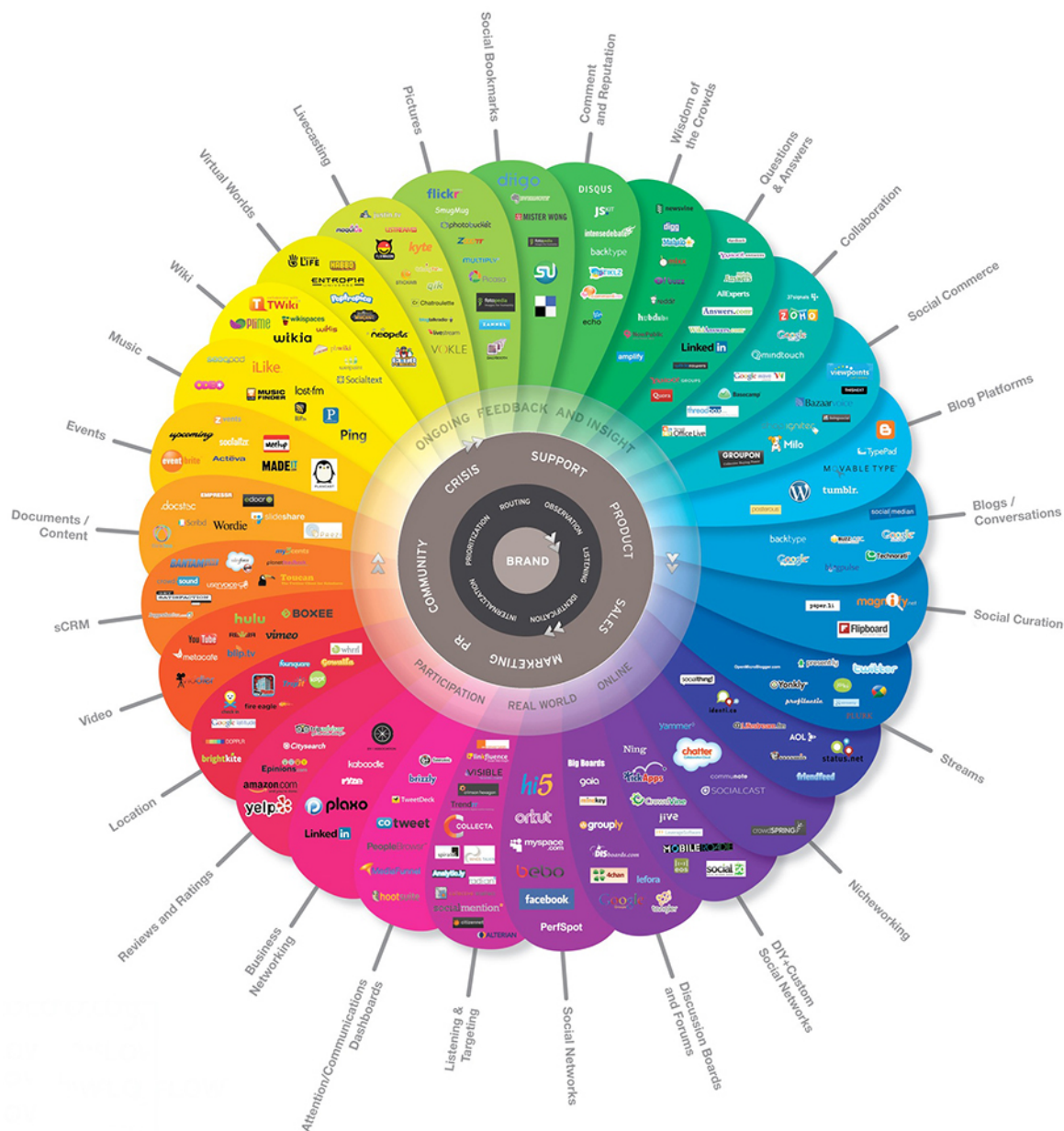
In the era of Web 2.0, this situation has worsened; human information is much more volatile than the information available from the traditional websites. Web 2.0 represents a new platform of the World Wide Web within which contents and applications are constantly being changed by users in a participatory and cooperative fashion (Kaplan and Haenlein, 2010). Figure 1.3 presents how the information flow has been shifted from bi-directional to multi-directional as the internet evolves.



[Figure 1.3] Changing landscape of the web (Source: MRM Milan, 2009)

In the Web 2.0 environment, particularly in social media, the profile of an individual continuously changes, while the information from a typical website remains static. For example, a person’s age increases yearly; location may continuously change; interests may vary over time; and work status, relationship status or contact details may change occasionally. Huberman, Romero and Wu (2009) claimed that this vast amount of dynamic information might result in decreased attention to social media. Another complexity is associated with multiple identifications. In particular, different identifications are needed for each social media site, and frequent demands for passwords in this situation can result in complexity (Breslin and Decker, 2007; Norman, 2011). Consequently, users should

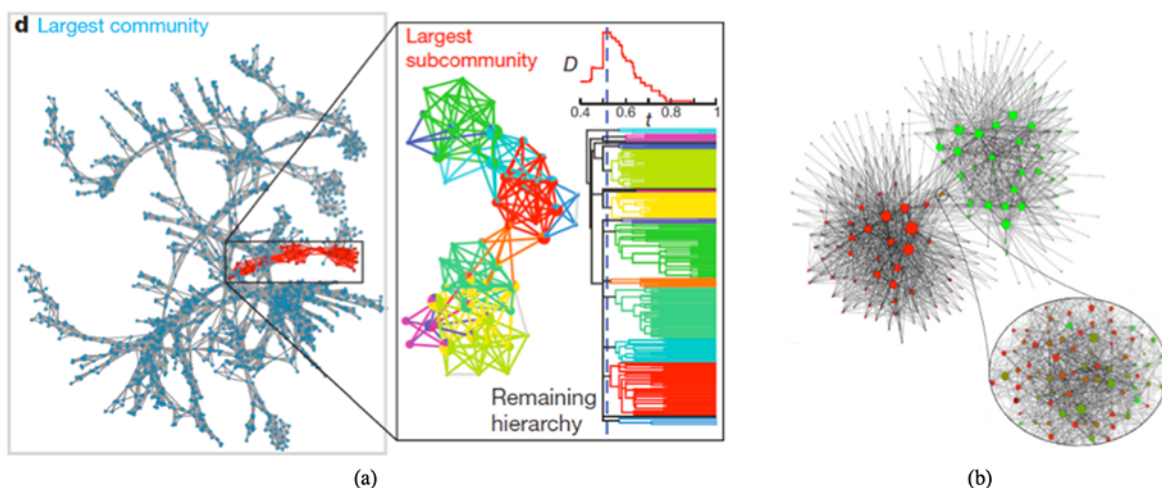
manage friends lists, connections, contacts or networks on an individual basis for every service, a problematic development which is often referred to as the “walled garden problem” (Yeung et al., 2009). Figure 1.4 presents the “Conversation Prism” introduced by Solis (2010), which provides a holistic view of the social media universe. It is possible to confirm not only how social media has thrived and proliferated in recent years, but also how sites are intricately woven and entangled.



[Figure 1.4] Conversation Prism (Source: Solis, 2010)

There is also a point of view that regards social media as a complex system. Miemis (2009) argued that many complex adaptive system’s key properties — such as “emergence, co-evolution, requisite variety, connectivity, simple rules, iteration, self organising, edge of chaos, and nested systems” — seem strikingly similar to what is occurring on Twitter.

Complex adaptive systems are, according to Merali and Allen (2011), “systems that adapt and evolve in the process of interacting with dynamic environments. Adaptation at the macro level (the ‘whole’ system) is characterized by emergence and self-organization based on the local adaptive behaviour of the system’s constituents”. In physics, Ahn, Bagrow and Lehmann (2010) and Fortunato (2010) tried to detect and link social community networks by analysing network graphs. Interestingly, the graphs shown in the research are very similar to fractal art images (Figure 1.5).



[Figure 1.5] Analysing network graphs in order to detect and link social community networks (Source: (a) Ahn, Bagrow and Lehmann, 2010; (b) Fortunato, 2010)

In complex cyberspace, software agents such as buyer agents, user agents, monitoring-and-surveillance agents and data mining agents have been used to help individuals (Haag, Cummings and McCubbrey, 2004). These software agents are designed to prevent users from being confused in cyberspace by assisting with mediating activities (Suchman, 2007). A large number of researchers have claimed that the principal purpose of a software agent is to perform complex tasks and to hide the complexity on behalf of the users. For example, Hermans (1997) claimed that software agents are capable of handling the complex, high-level tasks within the context that internet information sources are too diverse and too complex for most users. Serenko and Detlor (2004) also argued that software agents can offer users exciting and pleasurable experiences by helping them deal with complex applications in several networks (Jennings et al., 2000). The initial basis of a software agent’s assistive activities is to conceal the network infrastructure’s complexity while performing tasks automatically (Boudriga and Obaidat, 2004). According to Norman (2011), automation is one of the most effective strategies for the treatment of complexity; in order to be successful, the function should be completely automated by a system that is robust and reliable.

Within the context of social media, the general class of software agents referred to as “recommender systems” plays a decisive role in helping social media users to find their

friends, family members or connections. Recommender systems are software tools and techniques that offer suggestions to a user (Ricci, Rokach and Shapira, 2011). Such systems are typically used for helping customers in their product decisions as part of their service to customers (Häubli and Trifts, 2000). For example, Amazon's books, Netflix's movies and Pandora's music recommendations can be considered popular recommender systems (Sun, Lebanon and Kidwell, 2012). Aksoy et al. (2006) claimed that recommender systems have the potential to extend the level of service provided by companies operating within the online settings; indeed, such systems have played a huge role in providing users with quality experiences (Naruchitparames, Güneş and Louis, 2011). Most social media sites such as Facebook, Twitter and LinkedIn employ a recommender system. Over 56.4% of social media users in 2009 tried to use such a system (Garcia and Amatriain, 2010). Moreover, given the high number of online users and their various interests, Xie (2010) claimed that there are still great challenges for social media designers who want to help online users explore new friendships.

### **1.1.3 Privacy Issues and Software Agent as a Potential Solution**

The rapid growth of social network services in recent years has also caused privacy issues (Debatin et al., 2009). Privacy is defined as "the interest that individuals have in sustaining a personal space, free from interference by other people and organizations" (Clarke, 1999). Interdisciplinary studies related to the privacy issues in social network services have built up four main themes: users' information sharing behaviour, correlations between demographics and privacy behaviour, users' privacy awareness and changes in privacy settings (Jamal, 2013).

From the early stage, studies of privacy issues in social network services have focused on users' information sharing behaviour. For example, Gross and Acquisti (2005) identified that the personal data on the service were likely to contain potential threats to privacy. Acquisti and Gross (2006) also argued that users' address and class schedule left on the service resulted in the high level of exposure, which enabled potential stalkers to acquire the information. Fogel and Nehmad (2009) found that social network service users tended to have greater risk-taking attitudes than non-users. Later, Chen and Marcus (2012) found that collective and introverted users were more likely to disclose less honest and audience-relevant information online. Wu et al. (2012) identified users' willingness to disclose personal information depending on their culture, privacy concerns and the content of privacy policies. These studies mainly explored the current situation of users' information sharing behaviour at that time and raised potential risks and threats for future research.

Another main theme was finding correlations between demographics and privacy behaviour. For example, Barnes (2006) claimed that younger users tended to disclose more

information on social network services than older users and thus were often vulnerable to potential risks. Lenhart and Madden (2007) studied how social network service users' behaviour differed between different age groups and genders. Pfeil, Arjan and Zaphiris (2009) also investigated the age differences and similarities among MySpace users to explore possible variations in social capital between the young and old.

Studies on users' privacy awareness also have been one of the main themes. For example, Govani and Pashley (2005) found that only 40% of participants actually used the privacy settings on Facebook, although over 80% were attentive to them. Debatin et al. (2009) found that user satisfaction with social network services was greater than their perceptions of privacy threats; they also warned about the weak mechanisms in place to protect users' privacy. Litt (2013) identified that only certain groups used the technology for privacy protection, placing other user groups at risk. Stieger et al. (2013) noted that the users who deleted their accounts, which is referred to as "virtual identity suicide", had higher conscientiousness and cautiousness about privacy than those who retained their accounts. Bryce and Fraser (2014) found that teenagers were aware of the privacy risks, but were also more likely to disclose personal information and interact with strangers.

In 2009, when Facebook introduced the detailed privacy settings feature (Rothery, 2010), a new study theme concerning the complexity issue emerged. For example, Kirk (2010) claimed that Facebook's privacy settings were very confusing because they so frequently changed. He also noted that some users were not aware of these settings, which put their personal information at risk. Similarly, Rothery (2010) also claimed that many users not only were unaware of the privacy settings, but also found them confusing and complicated to navigate. Nevertheless, in their longitudinal study, Boyd and Hargittai (2010) found that the vast majority of teenage users in social network services modified their privacy settings, which contrasted with the assumption that teenagers failed to consider the issue. Tene (2011) also identified that young adults aged 18 to 29 were the most proactive in changing their privacy settings and keeping under control who can see their updates. Chen and Marcus (2012) also identified students' selective used of privacy settings to control how they were presented to others online.

Studies on privacy issues in social network services often focused on the aspects reflected in users' profiles, privacy settings or their verbally stated behaviour. Moreover, the majority of studies merely warned of the potential risks or suggested safeguards against possible threats and risks. In other words, relatively few studies focused on the practical approach or identified tacit information from users' instant non-verbal responses, resulted in lack of design support for addressing privacy concerns. Given that the field data (i.e., users' instant non-verbal responses) can play a crucial and effective role in overcoming the difficulties of discovering insightful tacit information (Beyer and Holtzblatt, 1998;

Alexander and Maiden, 2004; Holtzblatt, Wendell and Wood, 2005), it is arguable that the proposed research gap is significant from a designer's point of view.

As the software agents have played an important role for the complexity issue in cyberspace, the research described in this thesis proposes the software agent as a potential technical solution for addressing the privacy concerns. As a design intervention, the research investigates social network service users' emotional and behavioural responses through a human centred design approach. Dupré et al. (2012) have claimed that the analysis of users' emotional processes and behaviour is the key to the commercial success of innovations. The emotional response is, according to Desmet (2003) and Larsen et al. (2010), one of the most important factors in human life because it provides meaning and renders valuation. Numerous scholars agree that emotional responses may influence users' behaviour (Izard, 1971; Ekman, 1973; Fridlund, 1994; Frijda and Tcherkassof, 1997; Baumeister et al., 2007). For example, positive emotional responses may provoke active behavioural responses such as having willingness to approach, exploring new objects and expecting future experiences (Fredrickson, 1998; Fredrickson, 2001). A joyful emotional response in particular may trigger users' playful and creative behavioural responses (Dupré et al., 2012). Moreover, Rodriguez (2013) has also emphasised that negative emotions can be as important as positive ones towards understanding health issues, relationships or other important human matters. The analysis of social network service users' emotional and behavioural responses would help to create personas as a design solution for addressing the privacy issues.

## 1.2 Research Questions, Aim and Objectives

The research described in this thesis was motivated by the author's belief that a practical and pragmatic human centred design approach can help to fill the suggested research gap. Key research questions that are required to be answered are the following:

1. What are the opinions of the stakeholders regarding the current situation and the expected future of the social network service environment?
2. What are the main differences of the key emotional and behavioural responses between users in identical privacy infringement situations?
3. How can the analysis of users' emotional and behavioural responses contribute to designing a software agent to address the privacy issues?

The research aimed *to propose persona models for software agent development that contribute to addressing privacy issues in social network services based on the analysis of users' emotional and behavioural responses*. In order to achieve the research aim and to



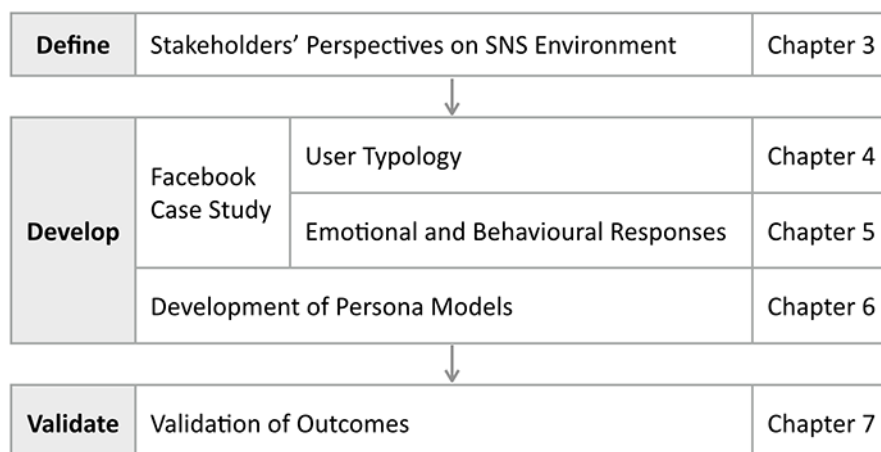
find the answers to the key research questions, the following research objectives were formulated:

1. To explore stakeholders' perspectives regarding the current situation and the expected future of the social network service environment;
2. To identify the main differences of emotional and behavioural responses between users in privacy infringement situations;
3. To create persona models based on the analysis of emotional and behavioural responses;
4. To validate the research outcomes using a software agent prototype developed based on the proposed persona models.

### 1.3 Methodology

The research described in this thesis followed a sequential process that consists of three main phases — definition, development and validation. Each phase was the subject of a major study. Figure 1.6 presents the overall research process.

The main goal of the definition phase was to confirm the research gap and to define users' prospective needs by exploring stakeholders' perspectives on the current situation and the expected future of the social network service environment. The study employed a qualitative interview research method. A stakeholder model was developed in order to structure the relationships among related stakeholder groups in the social network service sector and to logically recruit stakeholders for the interview.



[Figure 1.6] Overall research process to achieve the research aim

The development phase explored how social network service users can be classified into meaningful categories based on their perceptions of privacy and how differently they respond in terms of emotion and behaviour in identical situations of privacy infringement through a user-oriented experiment on Facebook. The study employed both a quantitative



and qualitative approach to collect and analyse data. Consequently, persona models of each user type were created by identifying relationships among users' perceptions of privacy, emotional responses and behavioural responses.

The validation phase validated the proposed social network service user typology and persona models using the quantitative approach. Based on the proposed persona models, software agent prototypes were developed. The validation process included (1) validating the user typology by replicating user classification and (2) validating the persona models by identifying the changes of key emotional responses after the intervention of the software agent prototypes.

## 1.4 Thesis Structure

This thesis consists of eight chapters. Chapters 2 through 8 are organised as follows:

- Chapter 2 reviews the literature relative to social network services, privacy, software agents and human centred design.
- Chapter 3 presents the qualitative interview study which explored stakeholders' perspectives regarding social network service environments.
- Chapter 4 presents the first part of the Facebook case study, which explored how social network service users might be classified into meaningful categories according to their perceptions of privacy.
- Chapter 5 presents the second part of the Facebook case study, which explored how each user group, classified in Chapter 4, differently responded in terms of emotion and behaviour in identical situations of privacy infringement through a user-oriented experiment on Facebook.
- Chapter 6 describes the creation of persona models based on the synthesis of the information from Facebook case study in Chapters 4 and 5.
- Chapter 7 describes the development of software agent prototypes and the validation of the proposed social network service user typology and persona models through a quantitative approach.
- Chapter 8 concludes the research by reconsidering the key research questions and illustrating major contributions. Recommendations for further research are also presented.

## Chapter 2. Literature Review

The literature review was conducted with regard to the theoretical investigation of the four main domains of the research: social network service, privacy, software agent and human centred design. This chapter consisted of three subsections — (1) social network service and privacy, (2) software agent for addressing privacy issues and (3) human centred design of software agents — to explore the links between the four theoretical areas and to determine the directions of the major studies by narrowing down the research scope.

### 2.1 Social Network Service and Privacy

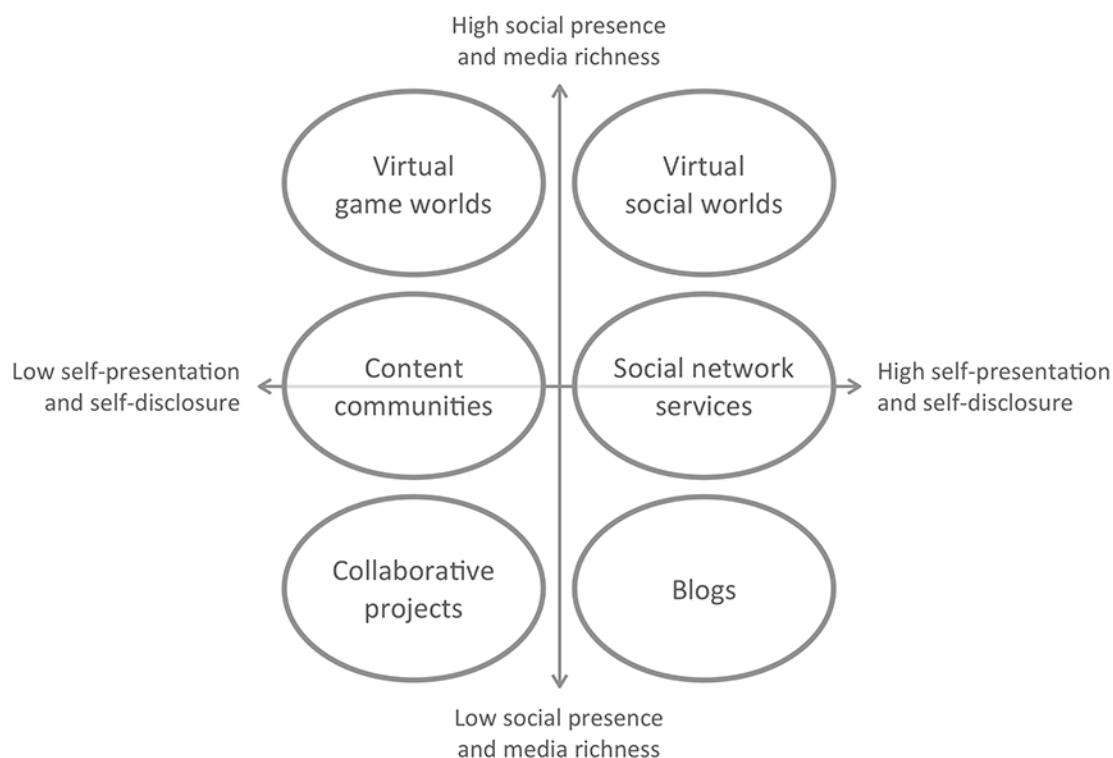
#### 2.1.1 Defining Social Network Service

##### *Types of Social Media*

Social media is “an umbrella term that refers to the set of tools, services, and applications that allow people to interact with others using network technologies” (Boyd, 2008a). This indicates that social media can be placed above social network service. Kaplan and Haenlein (2010) also defined social media as “a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content”.

According to Agichtein et al. (2008), social media includes not only social network service platforms such as Facebook and MySpace, but also blogs, web forums, social bookmarking services and photo/video sharing communities. These venues are called social media is because they emphasise the relationships among users. The power of social media is that it can connect people across time and space by employing mobile and web technologies to produce highly interactive platforms (Boyd, 2008a; Kietzmann et al., 2011). Individuals and groups can share, collaborate, discuss and modify user generated contents such as knowledge, information, media, ideas, opinions and insights.

Kaplan and Haenlein (2010) suggested a classification scheme based on media theories (social presence and media richness) and social processes (self-presentation and self-disclosure), which resulted in six types of social media: collaborative projects (e.g., Wikipedia); blogs; content communities (e.g., YouTube); social network services (e.g., Facebook); virtual game worlds (e.g., World of Warcraft); and virtual social worlds (e.g., Second Life) (Figure 2.1).



[Figure 2.1] Classification of social media by social presence/media richness and self-presentation/self-disclosure (Source: Kaplan and Haenlein, 2010)

- **Social presence and media richness:** Social presence is defined as “the acoustic, visual and physical contact that can be achieved” (Short, Williams and Christie, 1976). Media richness theory assumes that “the goal of communication is the resolution of ambiguity and the reduction of uncertainty” (Kaplan and Haenlein, 2010), which means that media differ according to the quantity of data allowed to be transferred in a specific time interval.
- **Self-presentation and self-disclosure:** The idea of self-presentation is that people wish to control the impressions created and organised by others in any kind of social interaction (Goffman, 1959), and such a presentation can be achieved through self-disclosure. Self-disclosure is the conscious or unconscious exposure of personal data in line with the image an individual would like to present to others (Kaplan and Haenlein, 2010).

### **Defining Social Network Service**

As the social media classification denotes, social network services represent a relatively new genre of social media platforms (Boyd, 2008a). Boyd and Ellison (2007) defined social network services as:

*“... web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they*

*share a connection, and (3) view and traverse their list of connections and those made by others within the system”.*

There are numerous definitions of social network service. For example, Lenhart and Madden (2007) defined a social network service as “an online location where a user can create a profile and build a personal network that connects him or her to other users”. Kwon and Wen (2010) also proposed the definition of social network service to be “an individual Web page which enables online, human-relationship building by collecting useful information and sharing it with specific or unspecific people”. According to Kirkpatrick (2010), a social network service is a system in which “users establish their position in a complex network of relationships, and their profile positions them in the context of these relationships, usually in order to uncover otherwise hidden points of common interest or connection”. Hargittai and Hsieh (2010) suggested that “users create an online profile on these sites by listing personal and professional information and interests, linking up with other users, and regularly sharing updates about the goings on in their lives with those in their networks”. Some of more detailed definitions are suggested by some researchers as follows:

*“Users of social network service can freely present themselves and interact with others via a myriad of communication modes such as photographs, bulletin boards, email and instant messengers. With the practice of ‘friends’ lists that manifestly connect individuals across space, social network services serve as a unique social venue wherein the users easily form and maintain their personal networks with existing and new connections” (Choi et al., 2011).*

*“Social networking services are websites that allow individuals to learn about and communicate with other users. Most services also allow users to establish a profile containing personal information (e.g., interests, religious and political beliefs, hobbies), indicate other users with whom they share a connection (i.e., friends), send private messages to other users, leave publicly viewable messages on others’ profiles, join social groups, and organise social gatherings” (Baker and Oswald, 2010).*

Looking into the types of social media and definitions of social network service, it is possible to understand the information on which users focus, the media they employ, the activities they can do within the services, the information they share and with whom they share the information. The keywords derived from the definitions are as follows:

- **Focus:** profile-based, relationship-based;
- **Media:** online, web-based, mobile-based;
- **Activities:** communicate, interact, share;

- **Sharing information:** a profile (personal information, interests, hobbies, etc.), a connection (friend), media (mostly text and photos);
- **With whom:** personal relationships, friends, network, professional connections.

This all suggests the following working definition of social network service which stemmed from the literature:

*... a profile-based and relationship-based online service via which users communicate, interact and share information such as their profiles, connections and media with their personal relationships, friends, networks and professional connections.*

The terms such as “social network(ing) site”, “social network(ing) service” and “online social network” are often used interchangeably. This thesis does not employ the term “networking”. Boyd and Ellison (2007) argued that “networking” usually emphasises the relationship initiation with strangers; however the primary intention of such services is not to meet strangers but rather to communicate with existing connections. Moreover, this thesis uses the term “service” rather than “site” because of the extension of media. The term “site” refers to a website, which can be viewed through web browsers (e.g., Microsoft Internet Explorer), whereas mobile internet use increases over time due to the proliferation of smartphones or tablet PCs; similarly, mobile applications for social networking continue to increase in number and popularity (Nielsen, 2011). For those reasons, this thesis uses the term “social network service”.

### **2.1.2 Motivations for Social Network Service Usage**

Muntinga, Moorman and Smit (2011) suggested six categories of classification of motivations for using social network services: entertainment, information, personal identity, remuneration, empowerment, and integration and social interaction.

#### ***Entertainment***

A number of researchers found that the entertainment is one of the most important motivations for using social network services. According to Muntinga, Moorman and Smit (2011), these services facilitate “escaping or being diverted from problems or routine; emotional release or relief; relaxation; cultural or aesthetic enjoyment; passing time; and sexual arousal”. For example, Shao (2009) found that consuming user generated content is related to entertainment, and Courtois et al. (2009) found that uploading contents elicits feelings of relaxation and escapism. Sangwan (2005) and Park, Kee and Valenzuela (2009) also found that participating in online communities or social network services is motivated

by entertainment. In addition, Kim, Kim and Nam (2010) claimed that content communities such as Flickr (photo), Last.FM (music) and YouTube (video) are also considered social network services because they often apply similar to those of social network services to satisfy users' needs for entertainment, recreation and education.

### ***Information***

The motivation related to the information includes updating status, searching for advice and opinions, and reducing risks (Muntinga, Moorman and Smit, 2011). According to Kim, Kim and Nam (2010), for instance, social network services fulfil the informational needs by keeping individuals constantly updated about their friends. Moreover, seeking advices and opinions (Wang and Fesenmaier, 2003; Kaye, 2007), exchanging information (Ridings and Gefen, 2004), voyeurism (Bumgarner, 2007) and surveillance (Courtois et al., 2009) are the most frequently mentioned information issues.

### ***Personal Identity***

The personal identity motivation is related to the self. It includes insight into self, personal value reinforcement and recognition gaining from peers (Muntinga, Moorman and Smit, 2011). Several studies have dealt with the personal identity motivation. Boyd (2008b) and Bumgarner (2007) identified impression management and identity expression as critical motivations for using social network services, and Papacharissi (2007) revealed that managing a weblog is motivated by a need for self-fulfilment. Barker (2009) also claimed that people with highly positive and collective self-esteem are strongly driven to communicate with their peer groups using social network services.

### ***Remuneration***

According to Muntinga, Moorman and Smit (2011), remuneration can be a motivation for contributing to online communities. For instance, people use social network services anticipating a future reward such as economic incentives (Wang and Fesenmaier, 2003), benefits related to jobs (Nov, 2007) or personal desires such as specific software (Hars and Ou, 2002).

### ***Empowerment***

Muntinga, Moorman and Smit (2011) defined the empowerment motivation as exerting influence or power on others or companies through using social network services. For example, Wang and Fesenmaier (2003) found that enforcing service excellence could be a

motivation to participate in online travel communities. Kaye (2007) found that people browse political blogs to determine whether or not broadcast media accurately report events.

### ***Integration and Social Interaction***

The integration and social interaction motivation includes obtaining a sense of belonging, connecting with others, looking for emotional support and replacing real-life friendship (Muntinga, Moorman and Smit, 2011). Integration and social interaction motivation would be the most important among the six categories of motivations for using social network services. Unsurprisingly, several studies have dealt with this motivation. For example, Subrahmanyam et al. (2008) found that social interaction is likely to be the most crucial motivation for using social network services. Lampe, Ellison and Steinfield (2008) also found that social network services could be helpful for maintaining or developing existing offline friendships or enhancing existing online friendships. Boyd (2008b) found that social identification played the most important role in people's contribution to social network services. Daugherty, Eastin and Bright (2008) found that social interaction was one of the most important motivations for creating user generated content. Kujath (2011) also found that the vast majority of young students used social network services for maintaining their offline friendships, while some preferred communicating online rather than face-to-face interaction.

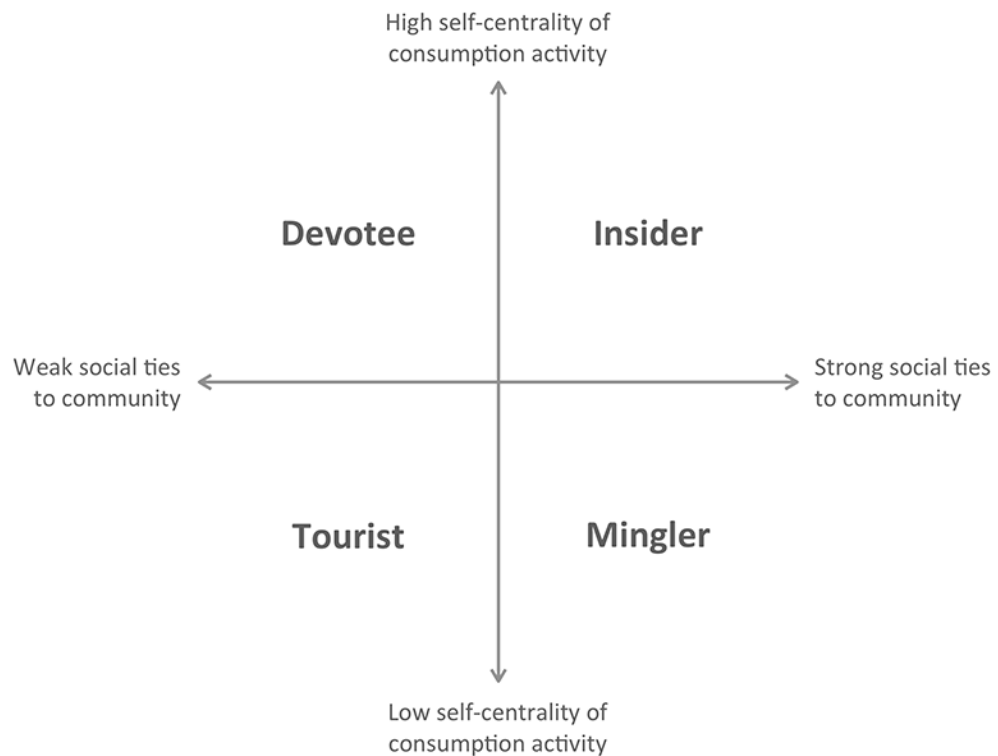
Examining these motivations carefully reveals that the integration and social interaction motivations as well as the other five motivations, are closely connected to the relationship with others, which corresponds with the meaning of the word social. This implies that the majority of people use social network services to meet their social needs appropriately.

### **2.1.3 User Types of Social Network Service**

#### ***Kozinets' Classification***

According to Brandtzæg and Heim (2011), classifying users into meaningful categories could be an effective approach to understand them. Kozinets (1999) suggested one of the influential typologies of virtual community members, in which two factors — the degree of self-centrality of consumption activity and the strength of social ties to virtual community — were employed to classify various types of community members (Figure 2.2).

- **Tourists** lack strong social ties to the group and maintain only a superficial interest in the consumption activity.
- **Minglers** maintain strong social ties, but are only perfunctorily interested in the central consumption activity.
- **Devotees** maintain a strong interest in and enthusiasm for the consumption activity, but have few social attachments to the group.
- **Insiders** have strong social ties and strong personal ties to the consumption activity.



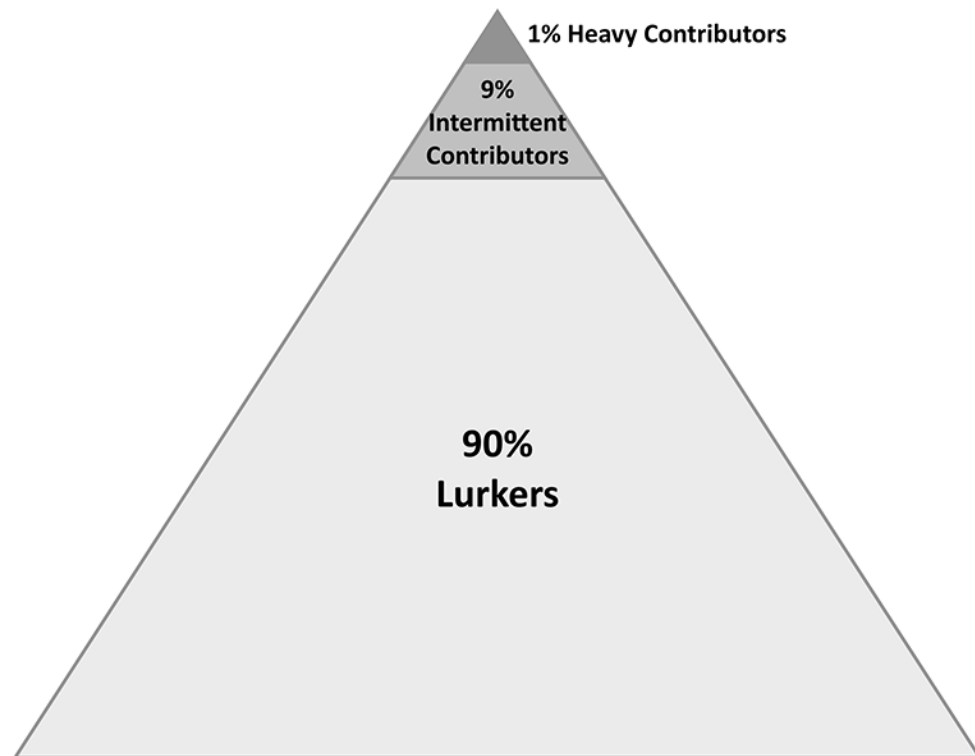
[Figure 2.2] Types of virtual community members (Source: Kozinets, 1999)

### ***Nielsen's Classification***

Nielsen (2006) also introduced an informal yet influential theory, the 90-9-1 rule, in his blog by describing the unbalanced nature of contribution to collaborative projects such as Wikipedia (Figure 2.3). Three categories following the 90-9-1 rule are as follows:

- **Lurkers** (90%) usually read or observe, but hardly contribute. There are no postings from these users.
- **Intermittent contributors** (9%) contribute from time to time, but contribution is not their priority.
- **Heavy contributors** (1%) actively participate and account for most contributions. Interestingly, 90% of posting are from these users.





[Figure 2.3] Types of collaborative project members (Source: Nielsen, 2006)

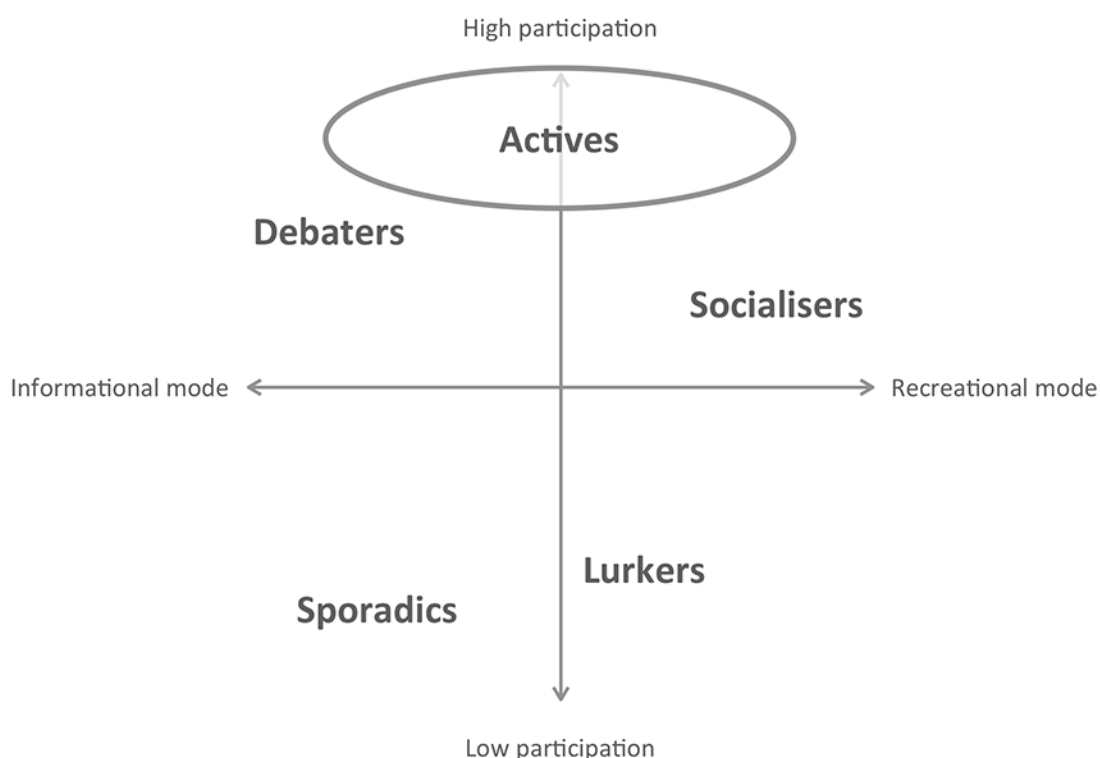
### ***Ofcom's Classification***

Kozinets (1999), Rogers (2003) and Nielsen (2006) classified users according to broader circumstances such as virtual community, technology adoption and collaborative projects rather than in social network services. These were usually based on theoretical assumptions rather than on an empirical approach. Office of Communication (Ofcom, 2008), the communications regulation firm based in London, proposed five social network service user types based on behaviour and attitudes using a qualitative approach:

- **Alpha socialisers** (a minority) use social network services in intense short bursts to flirt, meet new people and be entertained.
- **Attention seekers** (some) crave attention and seek comments from others, often by posting photos and customising their profiles.
- **Followers** (many) join social network services to keep up with what their peers are doing.
- **Faithfuls** (many) typically use social networking services to rekindle old friendships, often from school or university.
- **Functionals** (a minority) tend to be single-minded in using social network services for a particular purpose.

### **Brandtzæg and Heim's Classification**

Brandtzæg and Heim (2011) noted that existing user typology models associated with social network services tend to be based on a qualitative approach and that Ofcom's (2008) model was the only typology to specifically address social network services. Brandtzæg and Heim (2011) suggested five user types of social network services as a result of an empirical study on users' behaviour: sporadics, lurkers, socialisers, debaters and actives. Figure 2.4 presents how the five user types link to modes of communication and levels of participation.



[Figure 2.4] How different user types link to modes of communication and levels of participation (Source: Brandtzæg and Heim, 2011) (Note. "Actives" can be placed in anywhere on the matrix, but they are high in participation in all activities.)

- **Sporadics** (19%) visit social network services occasionally. They have a low level of participation and tend more toward an informational mode since primarily check their status and see if someone has contacted them.
- **Lurkers** (27%) are low in participation and primarily participate in activities related to recreation. These users are involved in several activities, but passively.
- **Socialisers** (25%) are often characterised by recreational behaviour such as small talk. Their participation level is high.
- **Debaters** (11%) have participation levels similar to socialisers. They are actively involved in discussions, and reading and writing in general.
- **Actives** (18%) are engaged in most kinds of activities. They socialise, debate and engage in several activities.

### **2.1.4 Privacy Issues in Social Network Services**

As mentioned in Section 1.1.3, the privacy issues have been caused by the rapid growth and influence of social network services (Debatin et al., 2009). Privacy is defined as “the interest that individuals have in sustaining a personal space, free from interference by other people and organizations” (Clarke, 1999). Although the privacy concern is one of the emerging issues in recent years in the social network service environment, discussions on privacy have historical origins in Aristotle’s distinction between the public sphere of politics and the private sphere of the family (DeCew, 2013) as Morozov (2013) claimed that “our contemporary privacy problem is not contemporary”. The privacy issues have existed since personal computers were popularised. According to Spinello (2011), computerised and digitised personal information has been efficiently and economically collected, stored and retrieved due to database technology. Easy transmission of digital information, which was caused by the advent of the internet, accelerated the threat to privacy. Such phenomena have led philosophers to re-examine and re-define “privacy” in terms of three different views (Bynum, 2011): control over personal information (Westin, 1967; Miller, 1971; Fried, 1984; Elgesem, 1996), restricting access to information (Moor, 1997; Tavani and Moor, 2001; Tavani, 2007) and privacy in public (Nissenbaum, 1998; Nissenbaum, 2004). Moreover, recent Web 2.0 technologies have evolved specifically to facilitate user-generated, collaborative and shared internet content, which has resulted in privacy issues being broader and more complex even to ordinary users (Vallor, 2012; Morozov, 2013). Interestingly, those privacy problems were already forecasted by several scholars before the actualisation. For example, Baran (1967) not only foresaw the current phenomenon of cloud computing (or “utility computing”) more than four decades ago, but he also insisted on the necessity of information privacy protection. Simitis (1987) also explored the same issue with Baran’s view concerning the automation of data processing.

According to Jamal (2013), interdisciplinary studies related to the privacy issues in social network services have built up four main themes: (1) users’ information sharing behaviour; (2) correlations between demographics and privacy behaviour; (3) users’ privacy awareness and (4) changes in privacy settings.

#### ***Users’ Information Sharing Behaviour***

From the early stage, studies of privacy issues in social network services have focused on users’ information sharing behaviour. For example, Gross and Acquisti (2005) identified that the personal data on the service were likely to contain potential threats to privacy. Acquisti and Gross (2006) also argued that users’ address and class schedule left on the service resulted in the high level of exposure, which enabled potential stalkers to acquire the information. Fogel and Nehmad (2009) found that social network service users tended

to have greater risk-taking attitudes than non-users. Later, Chen and Marcus (2012) found that collective and introverted users were more likely to disclose less honest and audience-relevant information online. Wu et al. (2012) identified users' willingness to disclose personal information depending on their culture, privacy concerns and the content of privacy policies. These studies mainly explored the current situation of users' information sharing behaviour at that time and raised potential risks and threats for future research.

### ***Correlations Between Demographics and Privacy Behaviour***

Another main theme was finding correlations between demographics and privacy behaviour. For example, Barnes (2006) claimed that younger users tended to disclose more information on social network services than older users and thus were often vulnerable to potential risks. Lenhart and Madden (2007) studied how social network service users' behaviour differed between different age groups and genders. Pfeil, Arjan and Zaphiris (2009) also investigated the age differences and similarities among MySpace users to explore possible variations in social capital between the young and old.

### ***Users' Privacy Awareness***

Studies on users' privacy awareness also have been one of the main themes. For example, Govani and Pashley (2005) found that only 40% of participants actually used the privacy settings on Facebook, although over 80% were attentive to them. Debatin et al. (2009) found that user satisfaction with social network services was greater than their perceptions of privacy threats; they also warned about the weak mechanisms in place to protect users' privacy. Litt (2013) identified that only certain groups used the technology for privacy protection, placing other user groups at risk. Stieger et al. (2013) noted that the users who deleted their accounts, which is referred to as "virtual identity suicide", had higher conscientiousness and cautiousness about privacy than those who retained their accounts. Bryce and Fraser (2014) found that teenagers were aware of the privacy risks, but were also more likely to disclose personal information and interact with strangers.

### ***Changes in Privacy Settings***

In 2009, when Facebook introduced the detailed privacy settings feature (Rothery, 2010), a new study theme concerning the complexity issue emerged. For example, Kirk (2010) claimed that Facebook's privacy settings were very confusing because they so frequently changed. He also noted that some users were not aware of these settings, which put their personal information at risk. Similarly, Rothery (2010) also claimed that many users not only were unaware of the privacy settings, but also found them confusing and complicated

to navigate. Nevertheless, in their longitudinal study, Boyd and Hargittai (2010) found that the vast majority of teenage users in social network services modified their privacy settings, which contrasted with assumption that teenagers fail to consider the issue. Tene (2011) also identified that young adults aged 18 to 29 were the most proactive in changing their privacy settings and keeping under control who can see their updates. Chen and Marcus (2012) also identified students' selective use of privacy settings to control how they were presented to others online.

## 2.2 Software Agent for Addressing Privacy Issues

### 2.2.1 Defining Software Agent

In order to understand the role of software agents more easily, it is necessary to look into the word "agent". Collins Concise Dictionary (2001) defines "agent" as "a person who acts on behalf of another person, business, government, etc." Oxford Dictionary of English (2010) defines "agent" in a more specific way as "a person who manages business, financial, or contractual matters for an actor, performer, writer, etc.", "a person or company that provides a particular service, typically one that involves organizing transactions between two other parties: a travel agent" or "a person who works secretly to obtain information for a government or other official body: a trained intelligence agent".

Such agents are supposed to intervene and assist. For example, travel agents act on behalf of travellers. Once they are hired, agents contact airlines, arrange flight schedules and book hotel rooms. This action is conducted *autonomously*. If flights or rooms are not available, they look for an alternative solution *continuously* until the client is satisfied. Travel agents act *proactively* and *reactively* in order to achieve the traveller's goal. The words "autonomous", "continuous", "proactive" and "reactive" describe the characteristics of these agents and are reviewed in Section 2.2.2. The Oxford Dictionary of English (2010) suggests another meaning of "agent" in terms of computing: "an independently operating Internet program, typically one that performs background tasks such as information retrieval or processing on behalf of a user or other program". "Agent" here refers to a software agent.

The concept of software agent appeared in the mid-1950's (Kay, 1984). Since that time, use of the term exploded without much agreement on meaning. According to Nwana (1996), even within the software research community, "software agent" has been an umbrella term for researchers and developers in diverse disciplines because various software agents can play many roles. For example, some programmes are considered agents because they are scheduled in advance to perform tasks on a remote system

(Bradshaw, 1997), because they serve a mediating role among individuals and systems (Wiederhold, 1992), because they act as an intelligent assistant (Boy, 1991; Maes, 1997) and because they migrate in a self-directed way from system to system (White, 1997). Wayner and Joch (1995) also claimed that “the buzzword agent has been used recently to describe everything from a word processor’s Help system to mobile code that can roam networks to do out bidding”. Although the concept of the software agents is extremely broad and comprehensive, these agents are designed to help people to use a specific system or service autonomously and with automation technology.

Etzioni and Weld (1995) suggested the definition of software agent by employing the notion of agent: “a computer program that behaves in a manner analogous to a human agent, such as a travel agent or an insurance agent”. More specifically, Smith, Cypher and Spohrer (1994) suggested that a software agent to be:

*“... a persistent software entity dedicated to a specific purpose. ‘Persistent’ distinguishes agents from subroutines; agents have their own ideas about how to accomplish tasks, their own agendas. ‘Special purpose’ distinguishes them from entire multifunction applications; agents are typically much smaller”.*

Maes (1995a) defined software agents as “computational systems that inhabit some complex dynamic environment, sense and act autonomously in this environment, and by doing so realise a set of goals or tasks for which they are designed”. Wooldridge and Jennings (1995) suggested that a software agent is “a hardware or (more usually) software-based computer system that enjoys ... properties” such as autonomy, social ability, reactivity and pro-activeness. Hayes-Roth (1995) claimed that software agents “continuously perform three functions: perception of dynamic conditions in the environment; action to affect conditions in the environment; and reasoning to interpret perceptions, solve problems, draw inferences, and determine actions”. Russel and Norvig (2010) stated that “an agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors”. A common understanding of the software agent is that it acts autonomously on behalf of people. Among them, the most clear and appropriate definition for the research described in this thesis is IBM’s definition: “software entities ... carry out some set of operations on behalf of a user or another programme with some degree of independence or autonomy, and in so doing, employ some knowledge or representation of the user’s goals or desires” (Gilbert et al., 1995). This definition includes the supportive, autonomous and proactive traits of the software agent as the lexical meaning of the word “agent” denotes.

### 2.2.2 Characteristics of Software Agents

As the definition of the software agent varies, so too do researchers' opinions on the characteristics of the term. Considering major references (Etzioni and Weld, 1995; Franklin and Graesser, 1996; Bradshaw, 1997; Rudowsky, 2004; Schermer, 2007) on the software agent from the information systems field, this research embraces Franklin and Graesser's (1996) classification of the software agent, which not only integrates all possible characteristics comprehensively, but also avoids duplication. Franklin and Graesser's (1996) enumerated nine properties: autonomous, reactive, goal-oriented, temporally continuous, communicative, learning, mobile, flexible and character. According to Franklin and Graesser (1996), all software agents should fulfil the first four properties; adding other properties makes them potentially useful software agents. The details of the nine characteristics are as follows.

#### ***Autonomous***

Gilbert et al. (1995) stated that "agency is the degree of autonomy and authority vested in a software agent". According to Castelfranchi (1994), software agents should be able to not only operate without the direct involvement or intervention of humans, but should also have some control over their own actions and internal states in order to achieve their goals. Franklin and Graesser (1996) also claimed that software agents can exercise control over their own actions. More specifically, Etzioni and Weld (1995) suggested that a software agent takes initiative and exercises control in the following ways:

- **Goal-oriented:** accepts high-level requests indicating what a human wants and is responsible for deciding how and where to satisfy the requests.
- **Collaborative:** does not blindly obey commands but can modify requests, ask clarification questions or even refuse to satisfy certain requests.
- **Flexible:** actions are not scripted; able to dynamically choose which actions to invoke, and in what sequence, in response to the state of its external environment.
- **Self-starting:** unlike standard programmes, directly invoked by the user; an agent can sense changes in environment and decide when to act.

Etzioni and Weld's (1995) classification differs from Franklin and Graesser's (1996) because some key properties, such as goal-oriented and flexible, are included to this category.

### ***Reactive***

Reactive means that software agents can recognise changes in their circumstances and respond to changes in a timely fashion to fulfil their design objectives (Wooldridge and Jennings, 1995). The goals of software agents that form the basis for a currently executing procedure “may be affected by a changed environment and a different set of actions may need to be performed” (Rudowsky, 2004). In order for software agents to perceive their environment, they may employ any type and number of sensors and react to sensory input using their actuators. According to Schermer (2007), it is possible to differentiate among software agents based on “various degrees of reactivity, ranging from purely reactive software agents on the one hand, to software agents that deliberate extensively before reacting on the other hand”. Some researchers (Maes, 1995a; Bradshaw, 1997) suggested that a more appropriate description in the latter case might be “sense and act”. According to Luck, McBurney and Preist (2003), sociological, legal and psychological theories of norms and group behaviour are related to the software agent development because the prediction of other agents’ actions is important to a software agent.

### ***Goal-oriented***

Etzioni and Weld (1995) suggested that goal-oriented software agents accept what a user wants and are responsible for deciding how and where to meet the requests. According to Wooldridge and Jennings (1995), software agents tend to exercise goal-oriented behaviour and take initiative to meet their goals rather than simply respond to their environment. Rudowsky (2004) also claimed that merely “reacting to an environment by mapping a stimulus into a set of responses is not enough”. Goal-oriented behaviour is thus required because users want software agents to act for them. In order to produce meaningful results, software agents should be able to recognise opportunities and take initiative. Many researchers (Wooldridge and Jennings, 1995; Rudowsky, 2004; Schermer, 2007) also described this property as a proactive characteristic. This property is a more specialised form of autonomy (Schermer, 2007). The software agent definition proposed by Maes (1995a) suggests not only a combination of autonomy and reactivity, but also goal-oriented property as an additional requirement.

### ***Temporally Continuous***

Software agents do not map “a single input to a single output and then terminates”; rather, they exercise a continuous process (Etzioni and Weld, 1995). Bradshaw (1997) also suggested that software agents should be able to persist the identity and state over a long period of time. The concept of continuity is relatively simple compared to other



characteristics, but is critical, as software agents cannot accomplish their goals without this property. In addition, according to Schermer (2007), the temporal continuity is important because software agents having an episodic memory can learn from previous experiences. This indicates that this property is essential for software agents to be able to have other properties such as learning.

### ***Communicative***

Communicative means that software agents can engage in complex communication through negotiation and/or cooperation with other software agents and humans to meet their design objectives (Etzioni and Weld, 1995; Wooldridge and Jennings, 1995; Franklin and Graesser, 1996; Rudowsky, 2004). According to Schermer (2007), this ability is important, especially in multi-agent systems. Issues of organisational design and political theory have become important in the design and evaluation of software agents in a multi-agent environment because they are comprised of interacting and autonomous entities (Luck, McBurney and Preist, 2003).

Software agents use a kind of software agent communication languages with other agents and a natural language with humans (Genesereth and Ketchpel, 1994; Schermer, 2007). Bradshaw (1997), however, claimed that software agents should have “knowledge level” (Newell, 1982) communication ability, which refers to the ability to communicate with a language that resembles more human-like speech acts, rather than typical “symbol-level” program-to-program protocols. According to Luck, McBurney and Preist (2003), speech act theory, a branch of the philosophy of language, has been used to assign meaning to the communication language of software agents. Similarly, argumentation theory, the philosophy of argument and debate, is used for the design of richer languages of software agents. The communicative ability is also labelled “social ability” (Genesereth and Ketchpel, 1994; Rudowsky, 2004).

### ***Learning***

Software agents should be able to automatically change and improve their behaviour based on their previous experiences and environment (Franklin and Graesser, 1996). Many scholars (Etzioni and Weld, 1995; Bradshaw, 1997; Rudowsky, 2004; Schermer, 2007) have employed the term “adaptable” rather than “learning” in this case. Making software agents adaptive makes it possible to achieve flexibility (Schermer, 2007). According to Maes (1995b), adaptivity may range from becoming familiar with trivial and short-term changes to dealing with significant and long-term changes in the environment. Particularly, if software agents can deal with long-term changes, they may be able to self-enhance and

improve their performance over time by accumulating knowledge from previous experiences and considering this knowledge when they need to perform similar actions in the future (Schermer, 2007).

### ***Mobile***

Although mobility is not an essential property of software agents, many researchers include it when describing software agent characteristics. Mobility is the ability of software agents to transport or migrate from one machine to another and across different system architectures and platforms around an electronic environment, particularly a network (White, 1994; Etzioni and Weld, 1995; Franklin and Graesser, 1996; Bradshaw, 1997; Rudowsky, 2004). It is, however, often better for software agents to communicate with remote systems at the same location for efficiency and security reasons (Schermer, 2007).

### ***Flexible***

Flexible means that actions are not scripted (Etzioni and Weld, 1995; Franklin and Graesser, 1996). In order to achieve flexibility, Bradshaw (1997) suggested “inferential capability”, which stands for the ability to “act on abstract task specification using prior knowledge of general goals and preferred methods”. Flexibility “goes beyond the information given, and may have explicit models of self, user, situation, and/or other agents” (Bradshaw, 1997). Franklin and Graesser (1996) did not include the flexibility among the four fundamental characteristics of software agent; however, some scholars (Etzioni and Weld, 1995; Wooldridge and Jennings, 1995) claimed that flexibility plays a significant role. According to Schermer (2007), an ability by itself to function autonomously is not sufficient for qualifying as a software agent. For instance, Jennings and Wooldridge (1998) suggested that software agents should be able to act autonomously in a flexible manner to fulfil their design objectives; this flexibility distinguishes software agents from mere objects. In this sense, Luck, Ashri and D’Inverno (2004) proposed software agents as “situated and embodied problem solvers that are capable of flexible and autonomous action”.

### ***Character***

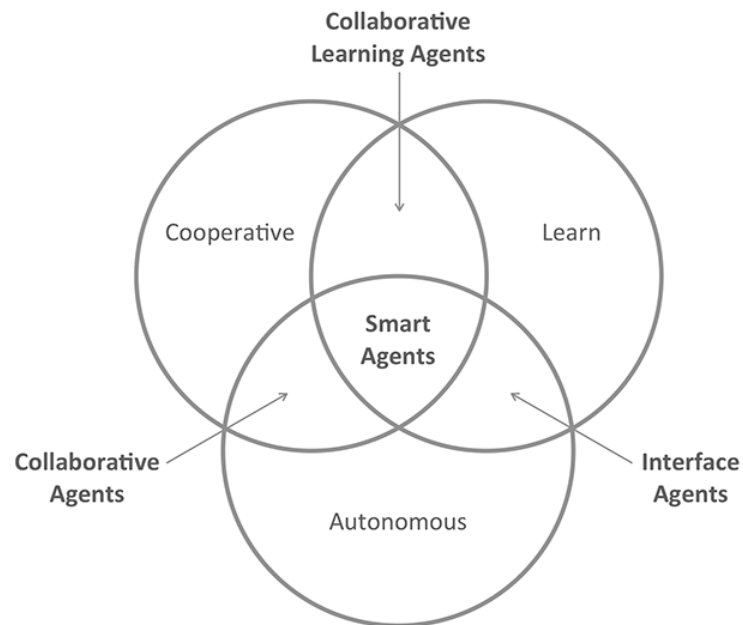
The property character means “the believable personality and emotional state” of software agents (Franklin and Graesser, 1996). Etzioni and Weld (1995) and Bradshaw (1997) also labelled this property “personality”, which refers to “the capability of manifesting the attributes of a ‘believable’ character such as emotion”, that makes interaction with humans

possible. This property is notable in terms of giving software agents human-like attributes. According to Wooldridge and Jennings (1995), the previously identified properties are related to weak and relatively uncontentious notions of software agent. Some researchers, however, have claimed that software agents have a stronger and more specific meaning and are conceptualised or implemented by concepts often applied to humans (Franklin and Graesser, 1996). For instance, Jonoski (2002) suggested the characterisation of software agents “using ‘mentalistic’ notions such as knowledge, belief, intention, desire, obligation etc.” Some scholars (Bates, Loyall and Reilly, 1992; Bates, 1994) discussed the role of emotion in software agents and suggested emotional software agents. According to Maes (1997), an alternative way of vesting software agents with human-like attributes is to use cartoon-like graphical icons or animated faces. Because of the human-like attributes, software agent studies have been influenced by philosophy (Luck, McBurney and Preist, 2003). For example, the philosophy of beliefs and intentions contributed to the development of a belief-desire-intention (BDI) software model, which views the system as a rational agent having certain mental attitudes such as informational, motivational and deliberative states (Rao and Georgeff, 1995). Philosophical theories of delegation and norms also influenced the issues of trust and obligations in multi-agent systems (Luck, McBurney and Preist, 2003).

### 2.2.3 Types of Software Agents

In the previous section, nine characteristics of software agents were identified. Any combination of those characteristics can be applied to software agents depending on the environments and tasks.

Nwana (1996) proposed a software agent classification based on several dimensions such as mobility, presence of a symbolic reasoning model, exhibition of ideal and primary attributes, roles, hybrid philosophies, and so on. Figure 2.5 presents a partial view of Nwana’s (1996) software agent typology, illustrating how four different software agent types — collaborative agents, collaborative learning agents, interface agents and smart agents — can be classified according to the dimensions of exhibition of ideal and primary attributes.



[Figure 2.5] A partial view of software agent typology (Source: Nwana, 1996)

### ***Collaborative Agents***

Collaborative agents “interconnect existing systems, such as expert systems and decision support systems, to produce synergy and provide distributed solutions to problems that have an inherent distributed structure” (Borking, Van Eck and Siepel, 1999). As shown in Figure 2.5, collaborative agents emphasise autonomous and cooperative aspects of software agents. Nwana (1996) stated that the key characteristics of collaborative agents include autonomous, communicative, reactive and goal-oriented. Therefore, collaborative agents can act rationally and autonomously in multi-agent environments. The motivation of systems employing collaborative agents may do one or more of the following:

- Solve problems that are too large for a centralised single agent due to resource limitations or the sheer risk of having one centralised system;
- Allow for the interconnecting and interoperation of multiple existing legacy systems;
- Provide solutions to inherently distributed problems;
- Provide solutions that draw upon distributed information sources;
- Provide solutions where the expertise is distributed;
- Enhance modularity (which reduces complexity), speed (due to parallelism), reliability (due to redundancy), flexibility (i.e., new tasks are composed more easily from the more modular organisation) and reusability at the knowledge level;
- Research into other issues.

### ***Interface Agents***

Interface agents “provide for personalised user interfaces, for sharing information learned from peer-observation, and for alleviating the tasks of application developers” (Borking, Van Eck and Siepel, 1999). As shown in Figure 2.5, interface agents emphasise autonomous and learning characteristics. According to Maes (1997), interface agents do not act as an interface or a layer between a user and an application; rather, they provide a user with a better experience because software agents can act as a personal agents by collaborating with the user. In regards to the learning, Maes (1997) suggested that the interface agents can learn in four different ways:

- They observe and imitate the user's behaviour.
- They adapt based on the user's feedback.
- They can be trained by the user on the basis of examples.
- They can ask for advice from other agents assisting other users.

According to Nwana (1996), the benefits of the interface agents can be described in three ways:

- They make less work for the end user and application developer.
- They can adapt, over time, to their user's preferences and habits.
- Know-how among the different users in the community may be shared (e.g., when agents learn from their peers).

### ***Mobile Agents***

Mobile agents are “computational software processes capable of roaming wide area networks (WANs) such as the WWW, interacting with foreign hosts, gathering information on behalf of its owner and coming ‘back home’ having performed the duties set by its user” (Nwana, 1996). These duties might vary from a flight reservation to managing a telecommunications network. Borking, Van Eck and Siepel (1999) suggested that employing mobile agents can contribute to the economisation of network utilisation by decentralising the decision process. This reduces communication costs and overcomes the limitations of local resources.

### ***Information (or Internet) Agents***

Information agents circumvent “drowning in data, but starving for information” (Borking, Van Eck and Siepel, 1999). Information agents were introduced as assistive tools for users to manage the rapid growth of data. Their main functions include the management,

manipulation and collation of data from several distributed sources (Nwana, 1996). According to Nwana (1996), it is important to distinguish information agents from collaborative agents or interface agents because there is considerable overlap due to the explosion of the web and the applicability of collaborative and interface agents to the WAN.

### ***Reactive Agents***

Reactive agents “do not possess internal, symbolic models of their environments; instead they act/respond in a stimulus-response manner to the present state of the environment in which they are embedded” (Nwana, 1996). These agents are relatively straightforward and communicate with different agents in basic ways. Nevertheless, these communications may cause complex patterns of behaviour when a group of agents is viewed as a whole (Borking, Van Eck and Siepel, 1999). Maes (1991) suggested three key ideas that underpin the reactive agents:

- **Emergent functionality:** The dynamics of the interaction leads to the emergent complexity.
- **Task decomposition:** A reactive agent is viewed as a collection of modules that operate autonomously and are responsible for specific tasks.
- **Raw representation:** Reactive agents tend to operate on representations that are close to raw sensor data.

### ***Hybrid Agents***

Each type of software agent mentioned so far has its own strengths and weaknesses. Hybrid agents “combine the strengths of different agent-design philosophies into a single agent, while at the same time avoiding their individual weaknesses” (Borking, Van Eck and Siepel, 1999). According to Nwana (1996), the assumption underlying hybrid agent application is that the benefits of a single agent in combination with different philosophies is greater than the benefits of the same agent with a single philosophy.

### ***Heterogeneous Agent Systems***

Heterogeneous agent systems, unlike hybrid agents, refer to “an integrated set-up of at least two or more agents which belong to two or more different agent classes” (Nwana, 1996). The main issue is to develop an agent communication language (ACL) because a single heterogeneous agent system may include several different agents. Thus, the

implementation of ACLs involves one of the following (Borking, Van Eck and Siepel, 1999):

- A rewriting of the existing software;
- A transducer, which acts as an interpreter of the original software's communication protocol and converts it to the ACL;
- A wrapper, which injects a modified communication software into the existing one.

Nwana (1996) suggested that one or more hybrid agents may also be included in a heterogeneous agent system.

## **2.2.4 Software Agent for Addressing Privacy Issues**

### **2.2.4.1 Software Agents in Social Network Services**

As already mentioned, the research described in this thesis focuses on the software agent within the context of a social network service. The following sections present reviews of two software agents that are often applied to social network services.

#### ***Recommender System***

One software agent in social network services is a recommender system specifically designed for suggesting friends. A recommender system is an intermediary program or an agent that compiles a list of requisite information regarding a user's tastes and needs (Mittal et al., 2010). The term was coined by Resnick and Varian (1997) for a system that gives personalised recommendations to stakeholders.

A recommender system uses the input data to predict users' potential likes and interest; thus, users' past evaluations are typically an important part of the input data (Lü et al., 2012). In detail, latent user preferences are assumed to be indicated by a wide range of observable data: features of the user, features of the items purchased by the user, behaviour of users with similar preferences, and so on (Huang, Chung and Chen, 2004). According to Arazy, Kumar and Shapira (2010), therefore, recommender systems play a significant role in reducing information overload in cyberspace, making them an important topic of academic research (Adomavicius and Tuzhilin, 2005). Many recommender systems have been implemented for various types of items such as newspapers, research papers, emails, books, movies, music, restaurants, web pages and other e-commerce products (Mittal et al., 2010). Suggestions for books on Amazon or movies on Netflix are examples of the recommender system (Melville and Sindhvani, 2011).

For social network services, the recommender system has a specific goal to help users find their friends and form relationships easily and efficiently so that the users visit the service more often (Wan et al., 2013), which represents the “goal-oriented” property. The system also searches and recommends potential friends based on data such as email contacts, common friends and interests (Chin, Xu and Wang, 2013). This represents the “temporally continuous” property. Once users sign up for the service, the system becomes activated automatically, starts to work immediately and acts for itself; there is nothing for the users to do (Zhou et al., 2012). Therefore, the system has the “autonomous” property. Finally, the system recognises everything taking place in specific services. For example, the system recommends a user as a potential friend if it detects shared friends, interests or email addresses (Xie and Li, 2012; Chin, Xu and Wang, 2013). In this way, the system responds to every change in the services. Therefore, the system has the “reactive” property.

The recommender system in social network services satisfies the four essential characteristics of a software agent (see Section 2.2.2). Given the definition, tasks and characteristics of the recommender system, it could be considered a collaborative agent type, which emphasises autonomous and cooperative aspects, among the software agent types identified by Nwana (1996). The number of social network service users is still increasing, making the recommender system one of the most indispensable software agents in social network services.

### **Web Feed**

Web feed (or news feed) is also one of central functionalities in social network services through which users can read aggregated recent updates of their friends’ activities such as status updates, and photos and videos updates (Cheung, Chiu and Lee, 2011; Bao, Mokbel and Chow, 2012; Shrivastav et al., 2012). In Facebook, the News Feed was introduced in September 2011 to provide users with updates in the form of top stories: the most recent stories for users who visit Facebook every hour and a summary of posts for less frequent users (Shrivastav et al., 2012).

Technologically, what enables the web feed is an application programming interface (API). The API, not a user interface but a software-software interface, allows communications between different applications or websites without any human intervention (Hsu, 2013). The web feed employs these APIs provided by various sources and lists specific contents that the users might be interested in based on their previous behaviour. In addition, the application that creates a new single web page by combining contents from various sources is called a “mashup” (Murugesan, 2007). As an extension of this idea, Bao, Mokbel and Chow (2012) proposed a new platform called “GeoFeed” that allows users to retrieve more



dynamic updates from the web feed based on the geographical location rather than a static point.

Like the recommender system, the web feed also has a specific goal to provide users an overview of the activities of their friends (Cheung, Chiu and Lee, 2011), which accounts for the “goal-oriented” characteristic. The web feed has the “autonomous” property as it becomes activated automatically, starts to work immediately and acts for itself once users sign up for the service (Hsu, 2013). Furthermore, the web feed continuously provides users with the latest updated activities of friends (Shrivastav et al., 2012), which means it recognises every change in the services. Therefore, the web feed has both “temporally continuous” and “reactive” characteristics.

The web feed also satisfies the four essential characteristics of a software agent (see Section 2.2.2). Given the definition, tasks and characteristics of the web feed, it can be considered an interface agent type, which emphasises autonomous and learning aspects, among the software agent types identified by Nwana (1996). Given the vast amount of information on the internet and rising number of connections formed through social network services, the web feed can be considered one of the essential software agents in social network services as well.

### **2.2.4.2 Software Agent as a Potential Solution for Privacy Issues**

As mentioned in Section 1.1.3, studies on privacy issues in social network services often focused on the aspects reflected in users’ profiles, privacy settings or their verbally stated behaviour. Moreover, the majority of studies merely warned of the potential risks or suggested safeguards against possible threats and risks. In other words, relatively few studies focused on the practical approach or identified tacit information from users’ instant non-verbal responses, resulted in lack of design support for addressing privacy concerns. Given that the field data (i.e., users’ instant non-verbal responses) can play a crucial and effective role in overcoming the difficulties of discovering insightful tacit information (Beyer and Holtzblatt, 1998; Alexander and Maiden, 2004; Holtzblatt, Wendell and Wood, 2005), it is arguable that the proposed research gap is significant from a designer’s point of view.

As the software agents have played an important role for the complexity issue in cyberspace, the research described in this thesis proposes the software agent as a potential technical solution for addressing the privacy concerns. As a design intervention, the research investigates social network service users’ emotional and behavioural responses through a human centred design approach. Dupré et al. (2012) have claimed that the analysis of users’ emotional processes and behaviour is the key to the commercial success



of innovations. The emotional response is, according to Desmet (2003) and Larsen et al. (2010), one of the most important factors in human life because it provides meaning and renders valuation. Numerous scholars agree that emotional responses may influence users' behaviour (Izard, 1971; Ekman, 1973; Fridlund, 1994; Frijda and Tcherkassof, 1997; Baumeister et al., 2007). For example, positive emotional responses may provoke active behavioural responses such as having willingness to approach, exploring new objects and expecting future experiences (Fredrickson, 1998; Fredrickson, 2001). A joyful emotional response in particular may trigger users' playful and creative behavioural responses (Dupré et al., 2012). Moreover, Rodriguez (2013) has also emphasised that negative emotions can be as important as positive ones towards understanding health issues, relationships or other important human matters. The analysis of social network service users' emotional and behavioural responses would help to create personas as a design solution for addressing the privacy issues.

### **2.3 Human Centred Design of Software Agents**

#### **2.3.1 Defining Human Centred Design**

The term "design" may be difficult to define in a single sentence. The Oxford Dictionary of English (2010) defines "design" in its noun form as "the art or action of conceiving of and producing a plan or drawing of something before it is made" or "the arrangement of the features of an artefact, as produced from following a plan or drawing". The same dictionary defines "design" in its verb form as "decide upon the look and functioning of (a building, garment, or other object), by making a detailed drawing of it". Giacomini (2014) therefore suggested that its meanings range "from the abstract conception of something to the actual plans and processes required to achieve it".

Design as an academic field is relatively new; nonetheless, the field, like society, has experienced dynamic changes within the last half a century. In other words, it may be possible to argue that design as an academic field has a huge social impact. In particular, Zhang and Dong (2009) described how the focus of design has shifted from function to human over the years (Figure 2.6). Before the 1950s, design focused more on function and was characterised by the slogan "form follows function". Between the 1950s and 1980s, design looked at users or consumers and focussed mainly on styling, worth, aesthetics and semantics. After the 1990s, design began to take the human element into consideration in a richer and more complex manner.

Before 1950s	<b>1950s</b> Growing society	<b>1960s</b> Mature society	<b>1970s</b> Saturated society	<b>1980s</b> Society of superfluity	<b>1990s</b> Society of satiety	After 2000s
<b>Function</b>	<b>Styling</b>	<b>Use worth</b>	<b>Aesthetic</b>	<b>Semantics</b>	<b>Self-presentation &amp; Experiential design</b>	<b>Interaction</b>
Function-focused  Consumer-focused  Human-focused						

[Figure 2.6] The shift of design focus in history (Source: Zhang and Dong, 2009)

According to Giacomini (2014), major movements in design fields in the 21st century can be classified into three paradigms: technology driven design, environmentally sustainable design and human centred design. Human centred design, in particular, has its roots in “semi-scientific fields such as ergonomics, computer science and artificial intelligence” (Giacomini, 2014). In 2010, the International Organization for Standardization (ISO, 2010) released the standard 9241-210 entitled “Ergonomics of Human-Centred System Interaction”, which defined human centred design as “an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques”. This definition, however, originated from an engineering and technological perspective and has been often referred to as user centred design rather than human centred design.

In fact, many human centred design studies (Maguire, 2001; Seffah, 2003; Rinkus et al., 2005; Knoche, Rao and Huang, 2011) usually focus on the usability of end-users from the engineer’s viewpoint, namely user centred design, while human centred design suggests a concern for people. The following statement by Jordan (2002) represents the latter view:

*“... usability is only one of the issues that will affect the overall relationship between a person and a product. The problem with usability based approaches is that they encourage a limited view of the person using the product. This is — by implication of not by intention — dehumanizing”.*

In other words, user centred design often emphasises usability rather than the experience of a product, system or service (Steen, 2008). Gasson (2003) suggested that “the human centred approach is opposed to the traditional, technology-oriented approach, which prioritises computer-based information processing and technology-mediated communications over human and their communicative collaboration”.

The evolution of design beyond such engineering based approaches was suggested by Maguire (2001), who emphasised the deliberate identification of stakeholders and usage contexts and the application of creative processes. Contextual design methodology suggested by Beyer and Holtzblatt (1998) and Holtzblatt, Wendell and Wood (2005) and the emotional engagement related studies (e.g., Jordan, 2000; Chapman, 2005; Norman, 2005; Oatley, Keltner and Jenkins, 2006; Coan and Allen, 2007; Kamvar and Harris, 2009; Hill, 2010) reflect this view.

More recently, Krippendorff (2004) emphasised that the core of design activity is to identify the “meaning” that products, systems or services should offer to people:

*“... human-centredness takes seriously the premise that human understanding and behavior goes hand-in-glove; that what artifacts are is inseparably linked to how their users perceive them, can imagine interfacing with them, use them and talk about their stake in them with others”.*

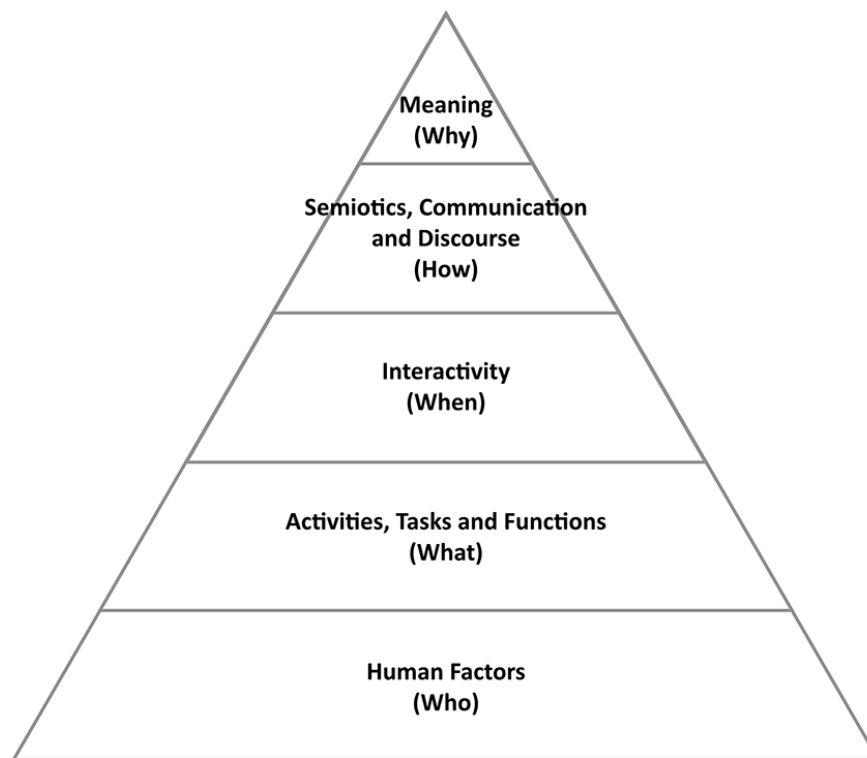
Giacomin (2014) also claimed that the customer does not always adopt a user’s perspective even though products, systems or services are often designed according to predetermined and preconceived cognitive plans and schema. Such ideas therefore define the human centred design from the designer’s point of view as:

*“... an approach that integrates multidisciplinary expertise towards enhancing human well-being and empowering people. It leads to products, systems and services which are physically, perceptually, cognitively and emotionally intuitive to use. More than a trend or a point of view, human centred design is a systematic gathering and deployment of knowledge about humans from the arts, humanities and sciences” (Giacomin and Love, 2011).*

Giacomin (2009) suggested that a human centred designer should be able to use information coming from a multidisciplinary perspective, including anthropometrics, arts, branding, emotional design, engineering, entrepreneurship, ergonomics, inclusive design, information architecture, perception, philosophy and psychology. In addition, according to Giacomin and Love (2011), the core of the human centred design is communicating, interacting, empathising and stimulating people so as to identify their needs, desires and experiences.

Along with the definition of human centred design, Giacomin (2014) also suggested the human centred design pyramid, which represents the answers to an incremental set of process-like questions that might be addressed by the human centred design approach (Figure 2.7). With its layered and hierarchical triangle, the human centred design pyramid clearly represents how the human centred design approach addresses each question

beginning from physical nature of people's interactions with products, systems and services (at the bottom) to more complex and metaphysical considerations (at the apex).



[Figure 2.7] Human centred design pyramid (Source: Giacomin, 2014)

### 2.3.2 Principles of Human Centred Design

ISO (2010) recommended six general principles of human centred design. These can be grouped into three categories: emphasising users, goal and implementation, and multidisciplinary approach. Despite being defined from an engineering perspective, ISO (2010) describes the fundamental principles in a comprehensive manner. Moreover, the categories correspond with the characteristics of human centred design suggested by Zhang and Dong (2009) (Table 2.1).

[Table 2.1] Principles of human centred design (Source: Zhang and Dong, 2009; ISO, 2010)

	Zhang and Dong (2009)	ISO (2010)
<b>Emphasising users</b>	<ul style="list-style-type: none"> <li>• Understanding people holistically</li> <li>• Involving users throughout the design process</li> </ul>	<ul style="list-style-type: none"> <li>• Explicit understanding of users, tasks and environments</li> <li>• Involvement of users throughout design and development</li> <li>• User-centred evaluation driven/refined design</li> <li>• The whole user experience design</li> </ul>
<b>Goal and implementation</b>	<ul style="list-style-type: none"> <li>• Making products or services useful, usable and desirable</li> </ul>	<ul style="list-style-type: none"> <li>• Iterative process</li> </ul>
<b>Multidisciplinary approach</b>	<ul style="list-style-type: none"> <li>• Multidisciplinary collaboration</li> </ul>	<ul style="list-style-type: none"> <li>• Multidisciplinary skills and perspectives</li> </ul>

### ***Emphasising users***

As presented in Table 2.1, human centred design emphasises human users in four ways: understanding users, involving users, user-centred evaluation and the whole user experience design.

- **Explicit understanding of users, tasks and environments:** Products, systems and services need to be designed for individuals who actually use them as well as for different stakeholder groups, including those who may be affected either directly or indirectly. All relevant users, tasks and environments therefore ought to be identified explicitly. One of the major causes of design failure is an inappropriate or incomplete understanding of such principles. It depends on the context how such products, systems and services are usable or accessible.
- **Involvement of users throughout design and development:** The involvement of users in design and development will provide a valuable source of knowledge concerning the context of use and also the tasks. It is also possible to observe in advance during the design or development process how users will cope with the new design of a product, system or service. User involvement can be exercised in many various ways: by collaborating in design, by acting as a source of relevant information or by evaluating solutions.
- **User-centred evaluation driven/refined design:** As an extension of the user involvement, evaluating designs with users and refining them based on their feedback is one way to minimise the risk that a product, system or service will not meet user or organisational needs. Such evaluation allows preliminary design solutions to be tested against the real world scenarios, with the results being fed back into progressively refined solutions.
- **The whole user experience design:** The concept of usability in ISO 9241-210 (ISO, 2010) refers not only to making products easy to use but also to perceptual and emotional aspects that are related to the user experience. The whole user experience design, therefore, includes considering organisational impacts, user documentation, on-line help, support and maintenance, training, long-term use, product packaging, branding and advertising.

### ***Goal and Implementation***

The final goal of human centred design is making products, systems or services useful, usable and desirable (Zhang and Dong, 2009). Once a product, system or service has been determined using the human centred design, four design activities need to take place:

- Understanding and specifying the context of use;

- Specifying the user requirements;
- Producing design solutions;
- Evaluating the design.

The iterative process until a desired outcome is fulfilled is typically required in order to achieve the goal. The iteration implies that descriptions, specifications and prototypes are revised and refined once new information is obtained so as to minimise the risk of the design of a product, system or service not meeting user or organisational needs.

### ***Multidisciplinary approach***

Human centred design teams do not need to be large; however, the team should be diverse enough to collaborate over design and implementation trade-off decisions at appropriate times. Potentially useful skill areas and viewpoints are as follows:

- Human factors, ergonomics, usability, accessibility, human-computer interaction, user research;
- Users and other stakeholder groups who can represent their perspectives;
- Application domain expertise, subject matter expertise;
- Marketing, branding, sales, technical support and maintenance, health, safety;
- User interface, visual and product design;
- Technical writing, training, user support;
- User management, service management, corporate governance;
- Business analysis, systems analysis;
- Systems engineering, hardware and software engineering, programming, production/manufacturing, maintenance;
- Human resources, sustainability and other stakeholders.

### **2.3.3 Human Centred Design Paradigm**

Recent evidence suggests that sound human centred design is becoming a prerequisite to commercial success in modern business environments. In particular, Von Hippel (2007) noted that “70% to 80% of new product development that fails does so not for lack of advanced technology but because of a failure to understand users’ needs”. This argument covers not only products but also services. For example, Zomerdijk and Voss (2010) claimed that customer experience in service design is critical for customer satisfaction and loyalty. Bitner (1990) also argued that responding to customer needs properly or failing to deliver services is strongly related to customer satisfaction. Giacomini (2014) discussed why human centred design is an important paradigm from the viewpoints of branding and business strategy.

### ***Human Centred Design and Branding***

According to Giacomini (2014), human centred design can be related to corporate branding models, by which several businesses position themselves with respect to their competitors. The four vector model of corporate identity, one of the influential branding frameworks by Olins (2008), is used for positioning a brand on the basis of four different senses: product, environment, communication and behaviour. The model can be claimed to be strongly human centred as it emphasises the brand's communication and behaviour within a specified environment (Giacomini, 2014):

- **Product:** what the organisation makes and sells;
- **Environment:** the physical environment of the brand, how it lays out its stall;
- **Communication:** how it tells people, every audience, about itself and what it is doing;
- **Behaviour:** how its people behave to each other and to the world outside.

Another influential model is the 4d branding model called "Brand Mind Space" by Gad (2000). Like the four vector model, the Brand Mind Space also employs four different dimensions for positioning a brand: functional, social, mental and spiritual. Giacomini (2014) claimed that this model is even more human centred because the four dimensions are defined by fundamental human needs:

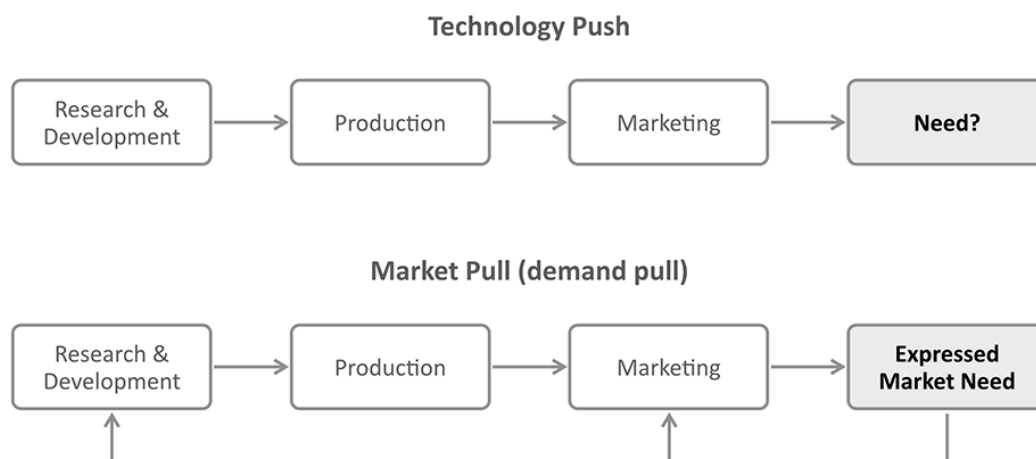
- **Functional:** perceived benefit of product or service;
- **Social:** the ability to create a social context for a group;
- **Mental:** the ability to create insight or guidance for the individual;
- **Spiritual:** perception of responsibility in industry, society, locally or globally.

Particularly in the last decade, the importance of addressing the cognitive, psychological, perceptual and emotional needs of customers has also been noted by various marketing and branding studies (Gobé, 2001; Lindstrom, 2005; Schultz, Antorini and Csaba, 2005; Von Hippel, 2005; Aaker, 2008; Lindstrom, 2008; Hill, 2010; Holt and Cameron, 2010; Shaw, Dibeehi and Walden, 2010; Du Plessis, 2011).

### ***Human Centred Design as Business Strategy***

Giacomini (2014) also discussed how human centred design can be compared with a business strategy. Two different paradigms of business strategy are suggested: technology push and market pull (Figure 2.8).





[Figure 2.8] Schematic presentation of technology push and market pull paradigms (Source: Martin, 1994)

The issue is that the value propositions of the technology pushing paradigms are typically based on the characteristics of technical novelty or technical optimisation instead of directly associated with the expectations, needs or desires of customers. The activities of another paradigm, market pull, are also often performed within the limits and confines of existing semantic and cognitive frameworks despite involving more active interactions with customers. In other words, interacting with customers within the limited boundaries of existing products, systems or services tends to produce only incremental innovation. For those reasons, neither the paradigm of technology push nor that of market pull is completely consistent with human centred design.

Human centred design, therefore, might use the hybrid form of the market pull business strategy once practiced as a process of questions and answers concerning the relationships established between the design artefact and the people. Through this strategy, the business proposes new meanings and attainable futures and responds to feedback. This suggests that human centred design depends critically on widespread communication, interaction and co-creation (Sanders and Stappers, 2008). As a business strategy, therefore, human centred design normally involves:

- A change of business strategy (Hatch and Schultz, 2008);
- Identification and integration of ethical challenges (Brown, 2005);
- Better communication of the vision (Temporal and Alder, 1998);
- Greater communication within the business (Gray, Brown and Macanugo, 2010);
- Greater interaction with the customers (Von Hippel, 2005);
- Greater communication between the customers (Cesvet, Babinski and Alper, 2009).

This paradigm may provide a systematic and scientific approach for developing products, systems and services based on matters of perception, interaction, learning and meaning (Giacomin, 2014).

### 2.3.4 Human Centred Design of Software Agents

Designers have participated in the software development process since the late 1980s by applying the human centred design (or user centred design) concept (Seffah and Metzker, 2004). Software developers and engineers usually consider the software development as a construction process from an engineering aspect (Göransson, Gulliksen and Boivie, 2003), meaning that they are more interested in the stability, quickness and accuracy of software performance or defects/bugs/faults in software testing. As explained in Section 2.3.1, however, designers focus on usability, which often influences “ease-of-use” and “user friendliness” (Seffah and Metzker, 2004). The following definition of “usability” by IEEE Standards Association illustrates this view: “The ease with which a user can learn to operate, prepare inputs for, and interpret outputs of a system or component” (IEEE, 1990). Unlike software developers, designers have shown interest in users from the usability perspective, prompting designers to examine the psychological aspects of users (Seffah, Gulliksen and Desmarais, 2005). The following definition reflects this view: “The capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions” (ISO, 2001).

For decades, usability studies by designers (e.g., Norman and Draper, 1986; Mayhew, 1992; Karat, 1997; Vredenburg, Isensee and Righi, 2002; Holzinger, 2003; Flood et al., 2013; Harrison, Flood and Duce, 2013; Jacob, Harrison and Faily, 2014) have built a human centred design community in the software development environment by developing various techniques. Consequently, usability has been recognised as one of the most important factors for the quality of interactive software systems (Seffah et al., 2006; Holzinger et al., 2008; Peischl, Ferk and Holzinger, 2015). More recently, scholars have recognised the limitations of existing usability model applications to mobile devices such as smart phones and tablet PCs and thus have been investigating new usability models in the mobile environment (e.g., Flood et al., 2013; Harrison, Flood and Duce, 2013; Peischl, Ferk and Holzinger, 2015). Furthermore, the human centred design approach has established itself as a progressive paradigm for social acceptance, commercial success, branding and business strategy by identifying “meanings” (see Section 2.3.1), which could be viewed as something beyond quality usability.

Key principles of human centred design in software development are in line with the general principles presented in Section 2.3.2. The following sections present 12 key principles of human centred design of software agent development suggested by Gulliksen and Göransson (2001), Gulliksen et al. (2003) and Göransson, Gulliksen and Boivie (2003).

### ***User Focus***

“User focus” is consistent with “explicit understanding of users, tasks and environments” mentioned in Section 2.3.2. Gulliksen and Göransson (2001) suggested that the designers must focus on users and tasks from the early stage of development. Gulliksen et al. (2003) also emphasised that project members need to understand the goal of an activity; usage context; users, their individual situations, goals, tasks, why and how they perform their tasks; and how they communicate, cooperate and interact with systems. These activities are particularly helpful in creating and maintaining a focus on users’ needs rather than on a technical aspect. Göransson, Gulliksen and Boivie (2003) stressed that user focus is critical to controlling the development.

### ***Active User Involvement***

“Active user involvement” is consistent with “involvement of users throughout design and development” mentioned in Section 2.3.2. Göransson, Gulliksen and Boivie (2003) and Gulliksen et al. (2003) suggested that representative users need to directly and actively participate in the development process from the early stage and be continuously involved throughout the system life cycle. Gulliksen and Göransson (2001) emphasised a careful selection of users based on their skills, for example, work domain experts throughout the development process and actual end-users for evaluations of the results. Gulliksen et al. (2003) also stressed the importance of identifying appropriate phases for user involvement and meeting the users in context.

### ***Evolutionary Systems Development***

“Evolutionary systems development” is consistent with “goal and implementation” mentioned in Section 2.3.2. “Evolutionary” means that the development process must be both iterative and incremental (Boehm, 1988; Gould, 1995; Göransson, Gulliksen and Boivie, 2003). The iterative process involves four activities: (1) analysing users’ needs and the context of use, (2) designing, (3) evaluating with suggestions for modifications and (4) redesigning based on the evaluation results (Gulliksen et al., 2003). Incremental development means that every increment should be implemented based on the iterative process above such that the software grows into the final system (Gulliksen et al., 2003).

### ***Simple Design Representations***

According to Kyng (1995) and Gulliksen et al. (2003), the design representations must be understandable, which allows users and stakeholders to fully grasp the implications of the design on their future use. Gulliksen et al. (2003) suggested employing prototypes and

simulations instead of abstract notations such as use cases, diagrams or requirements specifications.

### ***Prototyping***

To support the creative process, elicit requirements, visualise ideas and evaluate solutions, it is essential to develop various prototypes such as paper sketches or mock-ups and to collaborate with end-users from the early stage of the development process (Nielsen, 1993; Gould, 1995; Gulliksen and Göransson, 2001; Göransson, Gulliksen and Boivie, 2003; Gulliksen et al., 2003). Gulliksen et al. (2003) suggested beginning with low-fidelity materials such as quick sketches before implementation and emphasised the importance of the developed prototypes being evaluated by real users in context, which is referred to as “contextual prototyping”.

### ***Evaluate Use in Context***

“Evaluate use in context” is consistent with “user-centred evaluation driven/refined design” mentioned in Section 2.3.2. As mentioned previously, it is important to evaluate the design solutions based on the goals and criteria with real users in context (Gulliksen et al., 2003). Göransson, Gulliksen and Boivie (2003) and Gulliksen et al. (2003) particularly suggested empirical measurement activities such as directly observing, recording and analysing end-users’ behaviour, reactions, attitudes, opinions and ideas within the evaluation process, in which end-users perform real tasks.

### ***Explicit and Conscious Design Activities***

Cooper (1999) suggested that dedicated design activities should be included in the development process. User interface design and interaction design are critical to successful system development because the user interface is often recognised as the system itself for users (Gulliksen et al., 2003). In this sense, user interaction and usability need to be the result of explicit and conscious design activities.

### ***Professional Attitude***

“Professional attitude” is concerned with “multidisciplinary approach” presented in Section 2.3.2. Gulliksen et al. (2003) emphasised that effective multidisciplinary teams are important because different sets of skills and expertise are required for efficient system design and development. For example, system architects, programmers, usability

designers, interaction designers and users would perform the analysis, design, development and evaluation processes.

### ***Usability Champion***

Kapor (1990), Buur and Bødker (2000) and Gulliksen et al. (2003) suggested that not only users but usability experts should be continuously involved in the development process from the early stage. These experts are responsible for deciding on the issues relevant to the usability of the system and the future use scenario and acting as an “engine” for the development process (Gulliksen et al., 2003).

### ***Holistic Design***

“Holistic design” means that all aspects that affect the future use scenario need to be developed in parallel (Gould, 1995; Gulliksen et al., 2003). Gulliksen and Göransson (2001) also referred to this principle as “integrated design”. For example, work organisation, work practices and roles must be modified to develop a software for the support of work activities. This may include work/task practices and work/task organisation, user interface and interaction, on-line help, manuals, user training, work environment, health and safety aspects (Gulliksen et al., 2003).

### ***Process Customisation***

According to Göransson, Gulliksen and Boivie (2003), it is important to recognise that usability cannot be achieved without a human centred approach. However, it is necessary to customise and adapt the actual contents of a human centred design process, the methods and the order of activities based on organisation’s situation and needs because there is no universal process (Gulliksen et al., 2003).

### ***Human Centred Attitude***

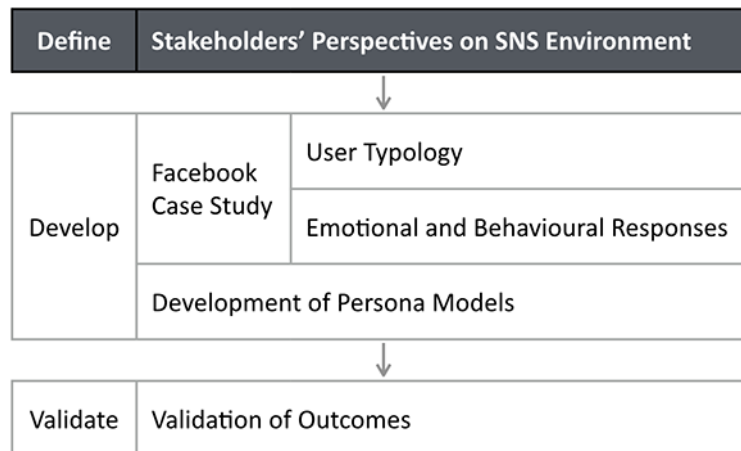
Although people’s degree of knowledge of human centred design may differ (Boivie et al., 2003), all stakeholders participating in software development, such as the project team, the development organisation and the client organisation, should be aware of and committed to the importance of usability and user involvement and should have a human centred attitude (Göransson, Gulliksen and Boivie, 2003; Gulliksen et al., 2003).

## 2.4 Summary

This chapter presented a literature relative to four main research domains: social network service, privacy, software agent and human centred design. First, social network service was defined based on the types of social media, and motivations for social network service usage and previous studies on social network service user types were reviewed. Previous studies related to the privacy issues in social network services were also reviewed. Second, software agent was defined based on the notion of agent, and the main characteristics and types of software agent were reviewed. Two software agents — recommender systems and web feeds — that are often applied to social network services were also reviewed. The two applications were confirmed as software agents based on the review of software agent characteristics, and their types were identified based on the review of software agent typology. As the software agents have played an important role for the complexity issue in cyberspace, the software agent was proposed as a potential technical solution for addressing the privacy issues in social network services. Third, human centred design was defined and discussed as a possibly important paradigm from the viewpoints of branding and business strategy. General principles of human centred design were also reviewed. Given the human centred design paradigm and principles, employing the human centred design approach was considered one of possible and progressive methods to understand and empathise with users and to provide them with with a collaborative, quality user experience. This chapter therefore suggested key principles of human centred design in software development to determine meaning from users' perceptions of and interactions with social network services.

Based on the information presented in this chapter, the next chapter explores relevant stakeholders' perspectives on the social network service environment through qualitative interview research in order to identify possible user needs. Understanding of the current situation will facilitate software agent design in the immediate future.

## Chapter 3. Exploring Stakeholders' Perspectives on Social Network Service Environment



Chapter 2 has dealt with the literature review with regard to the theoretical investigation of four main research domains: social network service, privacy, software agent and human centred design.

Based on the knowledge from the literature, this chapter explores stakeholders' perspectives to understand the current situation and possible future of the social network service environment through qualitative interviews. The main goal of this chapter was therefore to define possible needs of social network service users that should be considered in the software agent design process.

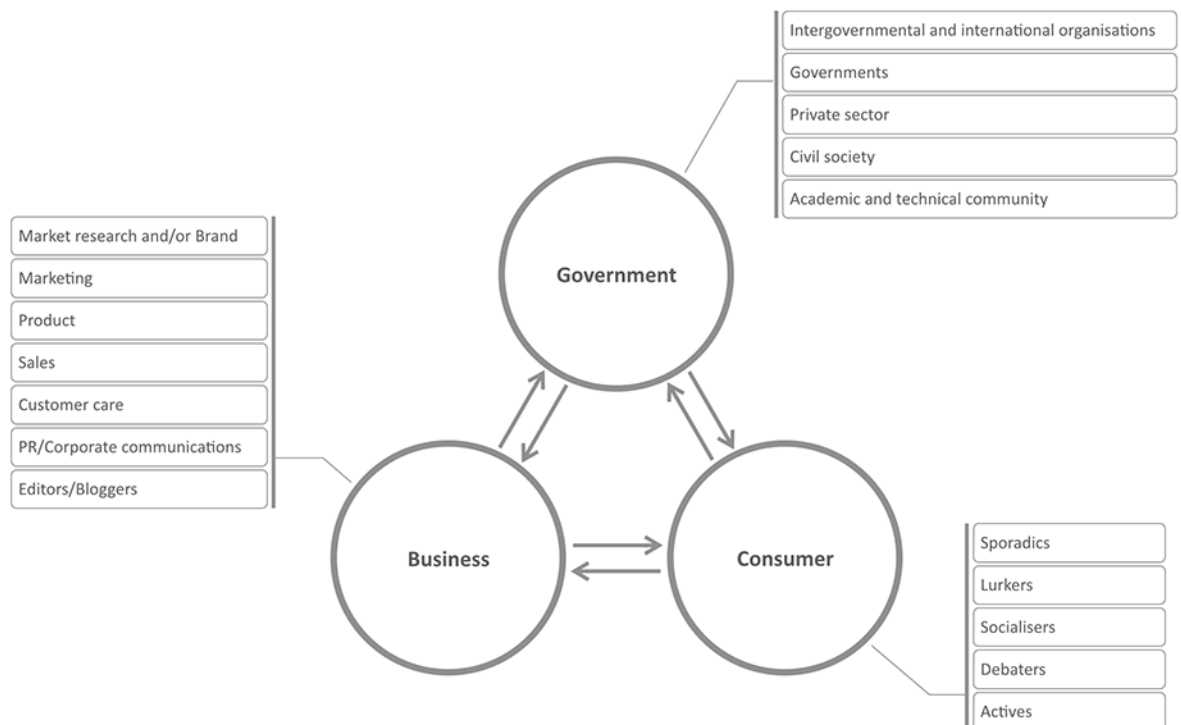
### 3.1 Study Design

#### 3.1.1 Stakeholder Model

Prior to conducting the interviews, a stakeholder model was developed in order to structure the relationships among related stakeholder groups in a social network service sector and to logically recruit stakeholders to interview. A stakeholder is defined as "any group or individual who can affect or is affected by the achievement of the organisation's objectives" (Freeman, 1984). Despite the criticism that stakeholder theory lacks sufficient theoretical content (Key, 1999), the theory has its strengths in multiple distinct aspects such as descriptive, instrumental and normative (Donaldson and Preston, 1995). The general approach was adopted from the study of Staniford et al. (2011) due to the similarity of the research method and stakeholder recruitment strategy.

The Organisation for Economic Co-operation and Development (OECD, 2007) suggested that the key stakeholder groups within the context of the social network service can be classified into the following categories: business, government and consumer (Figure 3.1). Each stakeholder group can be further divided into more detailed subcategories, which are adopted from existing studies and reports as follows:

- **Business:** Market research and/or brand, marketing, product, sales, customer care, PR/corporate communication and editors/bloggers (Lippay, 2009);
- **Government:** Intergovernmental and international organisations, governments, private sector, civil society and academic and technical community (WGIG, 2005);
- **Consumer:** Sporadics, lurkers, socialisers, debaters and actives (Brandtzæg and Heim, 2011).



[Figure 3.1] Stakeholder model in social network service sector (Source: WGIG, 2005; OECD, 2007; Lippay, 2009; Brandtzæg and Heim, 2011)

Developing the stakeholder model helped to form a purposive sampling strategy (David and Sutton, 2011) to recruit stakeholders who engaged in social network service sector and represented each subcategory. The stakeholder model therefore played an important role in covering all the possible areas in each stakeholder group and reducing any potential sampling bias when selecting interviewees.



#### 3.1.2 Research Approach

The study described in this chapter employed a qualitative interview research method, which is particularly suitable for a study that aims to explore opinions about a specific matter/situation or to understand the respondents' backgrounds (Easterby-Smith, Thorpe and Lowe, 2002). Although the interview research method has limitations such as arduousness, lack of efficiency and difficulty in assessing reliability and validity (Stanton et al., 2005), there are some significant merits:

- Providing an effective way to collect a wide range of data (Stanton et al., 2005);
- Uncovering new clues, opening up new dimensions of a problem and securing vivid, accurate and inclusive information based on personal experience (Burgess, 1991);
- No difficulty of missing returns, which results in more effective control of samples (Kothari, 2004).

#### 3.1.3 Interview Type, Format and Questions

According to David and Sutton (2011), the interview type can be distinguished by two criteria, standardisation and structure. Standardisation refers to “the level of closure placed around the answers interviewees can give”, and structure refers to “the degree to which the form and order of questions asked are kept identical from interview to interview” (David and Sutton, 2011). Since this study focused on the exploratory analysis, the stakeholders were asked open-ended questions, making the interviews “unstandardised”. Open-ended questions allow researchers to identify insightful replies that are not covered by closed (or fixed-choice) questions (Bryman, 2004).

The interviews were structured with the same sequence of questions for all stakeholders in order to compare the three stakeholder groups' opinions on social network service environments. The interview structure comprised the following five categories based on previous reviews of social network services in order to explore the current situation to the expected future of the social network service sector:

- Main stakeholders in social network service sector (OECD, 2007);
- Examples of software agents in social network services (Mavridis, 2011);
- Business/government strategy and customer experience (Boyd and Ellison, 2007; Morozov, 2013);
- Key issues in social network services (Preibusch et al., 2007);
- Expected future of the internet and social network service (Breslin and Decker, 2007).

Despite the same structure, wording for the questions was flexible to account for the different standpoints of the three stakeholder groups (Saunders, Lewis and Thornhill, 2012). Some prompts were also used in order to elicit additional and detailed information depending on the initial replies (David and Sutton, 2011). Thus, these interviews were “semi-structured”. Table 3.1 presents a set of interview questions for the business stakeholder as an example (see Appendix A.1 for the interview questions for all stakeholders, p. 187).

[Table 3.1] Interview questions for business stakeholder

Category	Question
Main stakeholders in social network service sector	1. In your opinion, who do you feel are the main stakeholders with whom you are connected? 2. What is the nature of the relationships with the stakeholders?
Examples of software agents in social network services	3. In your opinion, what do you think are good examples of software agents in social network services? Please give me some examples. 4. Why do you think they are good examples?
Business strategy	5. If possible, could you please talk about any project in which you were/are involved related to the software agent design or development in social network services? 6. What was/is your main strategy for the design or development?
Key issues in social network services	7. What kind of issues did/do you face? When and why do you think they have occurred? 8. How did/do you deal with the issues? 9. How do you take the difference of user types into consideration when designing or developing software agents in social network services?
Expected future of the Internet and social network services	10. In your opinion, how do you think the Internet and social network service trends are going to be changed in the near future?

For coherence and consistency, only one interview format was used. Although a face-to-face interview (or video interview) format would be the best choice in terms of the rapport between interviewer and interviewee (Bryman, 2004) and the ability to collect tacit and non-verbal information (Selwyn and Robson, 1998), an email format was chosen in consideration of the stakeholders' availability and preferred choice. Despite the lack of the above advantages of the face-to-face interview format, the email interview format has some benefits as follows:

- It is not constrained by participants' geographical location or time-zone (Foster, 1994; Bryman, 2004).
- Interviewees' answers are often more detailed and considered than those obtained in face-to-face interviews due to their greater commitment and motivation (Curasi, 2001).

- It does not require additional transcription so that the collected data can be analysed exactly written. This saves researcher time and money and also eliminates any errors that might originate from incorrect transcription (Selwyn and Robson, 1998; Curasi, 2001; Bryman, 2004).
- The lack of rapport, previously mentioned as a disadvantage of the email interview, can be considered a benefit because it reduces the problem of the interviewer effect (Boshier, 1990).

#### 3.1.4 Sampling and Data Collection Procedure

Prior to recruiting participants and collecting data, the research ethics approval was applied for and granted by the University Research Ethics Committee. Based on the stakeholder model in Section 3.1.1, a total of 21 stakeholders were recruited — 14 in the business and government stakeholder groups through LinkedIn, and seven in the consumer stakeholder group through Facebook (see Appendix A.2 for the interview participants profiles, p. 191). As an alternative to the sampling approach of quantitative studies in terms of the size, this study embraced a “theoretical saturation” concept in which researchers carry on sampling until no new or relevant data seem to be emerging (Strauss and Corbin, 1998). During the data collection process, theoretical saturation was achieved before the sample size met the predetermined number of 21. According to Strauss and Corbin (1998), the data collection process should be stopped with saturated data. However, there were seven subcategories of the business stakeholder group, so at least seven stakeholders for each group were required to cover all subcategories. In addition, to statistically analyse the perspectives of the three groups, the number of stakeholders in each group had to be constant. Therefore, the sampling process was carried on until the sample size reached 21 with seven stakeholders for each group. This number was considered adequate given theoretical saturation and the exploratory nature of analysis.

A purposive sampling strategy, which is one of the non-probability sampling methods often adopted by qualitative studies to select respondents relevant to the research topic area (David and Sutton, 2011), was employed in accordance with the responsibilities of the subcategories in the stakeholder model. Respondents in this case are information rich and illuminative and thus can provide useful opinions on the phenomenon (Patton, 2015). Additional criteria, including business sector, market capitalisation and experience, were considered to narrow down the target further and to enhance the representativeness of the chosen stakeholders (Table 3.2).

Initial contacts were made with professionals and users through LinkedIn and Facebook. Invitations were sent out to 45 people in the business stakeholder group, 33 in the government stakeholder group and 16 in the consumer stakeholder group until a

predetermined sample size of 7 for each group was reached. Once the stakeholders agreed to participate in the interviews, they were asked to provide the researcher with their email addresses so that they could receive the questionnaire. The first questionnaires were sent out to the stakeholders from March to May 2013. Despite the email format of the data collection method, the stakeholders were requested to answer the open-ended questions in a conversational style. The stakeholders responded within one to two weeks. The second questionnaires were sent out promptly to the stakeholders for additional and detailed information (prompting and probing) depending on replies to the first questionnaires. To help the stakeholders fully understand the terminology, definitions of main terms such as social network service and software agent were included in the invitations and questionnaires along with the research background.

[Table 3.2] Descriptions of each criterion for narrowing down the interview sample

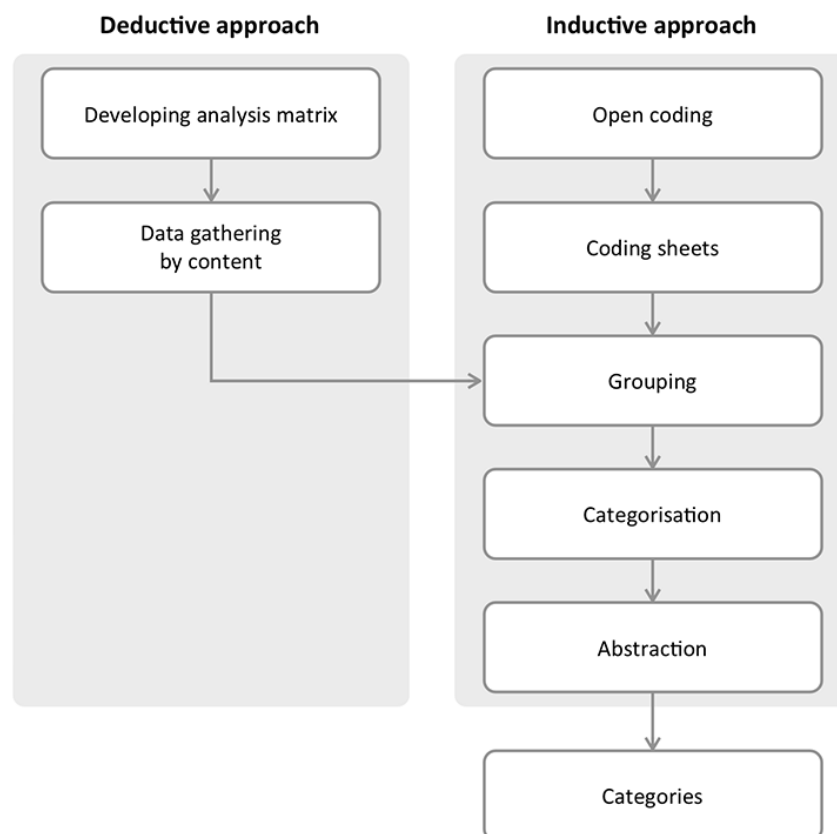
Criteria	Qualifications	Reasons
Business sector	Web-based and mobile-based services	Only mobile-based social network services are still in their infancy, thus providers that offer both web-based and mobile-based services tend to have accumulated and sufficient experience.
Market capitalisation	More than \$10 billion	According to Bloomberg (2012) and YCharts (2012), influential financial companies which provide market data and investment information, prevailing, experienced and long-lasting social network services worldwide have more than \$10 billion market capitalisation.
Experience	More than five years	Most social network services that are currently in use have been in existence from 2003 onwards (Boyd and Ellison, 2007), thus having more than five years of career or usage experience can result in to have appropriate and sufficient knowledge.

### 3.1.5 Data Analysis

The interview data yielded approximately 120 pages of narrative texts. The qualitative data were managed using the NVivo 10 software (Bazeley and Jackson, 2013) for computer aided coding. Qualitative content analysis, which is a method used to analyse written, verbal or visual communication messages (Cole, 1988), was employed for the data analysis. According to Elo and Kyngäs (2008), qualitative content analysis can be a suitable strategy to analyse large volumes of textual data and to define fewer content-related categories. Categories are the outcomes of the analysis that describe the phenomenon in the broad context (Elo and Kyngäs, 2008). Despite criticism of the qualitative content analysis method, such as lack of detailed statistical analysis (Morgan, 1993), this study used the method because of its noted benefits:

- Content-sensitive method (Krippendorff, 1980);
- Flexibility of research design (Harwood and Garry, 2003);
- Resulting simplistic description of data (Cavanagh, 1997);
- Understanding the meaning of communication (Cavanagh, 1997);
- Concerned with meanings, intentions, consequences and context (Downe-Wamboldt, 1992).

The study described in this chapter employed both deductive and inductive approaches to analyse the interview data (Figure 3.2). The deductive approach is often used when existing data need to be retested in a new context (Catanzaro, 1988). Therefore, it allows researchers to confirm an earlier theory or model (Burns and Grove, 2005). The first step of the deductive analysis is to develop an analysis matrix that included the five categories mentioned in Section 3.1.3. After that, the interview data are reviewed for content and coded into the corresponding categories (Polit and Beck, 2004). The coded data are then included in the grouping step of the inductive approach in order to support the inductive content analysis process.



[Figure 3.2] Process of qualitative content analysis (Source: Elo and Kyngäs, 2008)

The inductive approach is used to observe particular instances from the data and combine them into a general statement (Chinn and Kramer, 1999), which means the categories emerge from the data (Elo and Kyngäs, 2008). The first step is open coding, in which the

researcher makes notes and headings as necessary while reading a text (Elo and Kyngäs, 2008). After the open coding process, the headings are collected in coding sheets (Cole, 1988; Downe-Wamboldt, 1992) — this study used NVivo 10 software instead of coding sheets — and categories are generated (Burnard, 1991). The generated categories with similar contents (subcategories) are grouped together as higher order categories (generic categories), and those categories are grouped again into even higher order categories (main categories). This process of generating and grouping categories is referred to as an abstraction (Dey, 1993; Robson, 2011).

The coding team consisted of three design researchers (including the author) with experience in qualitative analysis, ethnographic interviewing and content analysis to reduce possible subjective bias and to ensure impartiality. The interview transcripts were distributed to the coding team members to generate categories individually in accordance with the process shown in Figure 3.2. Categories generated by each coder were collected and compared in several interpretation sessions to draw the final results.

## 3.2 Results and Discussion

Table 3.3 presents the main categories, generic categories and subcategories defined by the analysis. A description of the main findings is provided and organised into individual sections and subsections based on the main category, generic category and subcategory. The following sections present exemplary interview transcripts and discussion for each generic category.

### 3.2.1 Comprehensive Understanding of Users' Perceptions of Privacy

#### ***Privacy Infringement***

As expected, all the stakeholders raised the issue of the privacy infringement as the most critical issue in social network service environment ( $N_B=7$ ,  $N_G=7$ ,  $N_C=7$  — Each number indicates statistical results from business, government and consumer stakeholder groups).

*“I think ethical issues around security and privacy are primary concerns of users and, therefore, regulators and policy makers. They are concerns that software agents should take very seriously.” (Business)*

*“For users, ethical issues like privacy are absolutely a big problem.” (Government)*

*“I think the privacy issue of social network services is the most imminent problem of today.” (Consumer)*

[Table 3.3] Main categories, generic categories and subcategories defined by qualitative content analysis

Subcategories	Generic Categories	Main Categories
Identity theft Unwanted disclosure of personal information Hacking Invisible features Unforeseen predators	Privacy infringement	
Sharing and socialising nature of social network services Inevitable privacy issue Impossible to be completely safe Users are keen to socialise with others	Dilemma between networking and privacy concerns	Comprehensive understanding of users' perception of privacy
Reassuring security Adequate privacy safeguards Users' risk awareness and appropriate privacy settings Users' responsibility for their own personal information Policy for sharing information Rules/laws for sharing/owning information Security and privacy right education	Need of rigorous privacy policy	
Businesses not considering the user type for customised services Governments applying all the same policies to every user Increasing difficulties in identifying users' varied behaviour	Difficulties in providing customised services	User type recognition algorithms for software agent development
Software agents which recognise the user type automatically Software agents which assess users' personalities	Software agents for user type recognition	
Expectation of more new functions added to the services No reason to choose new services with the same functions as Facebook	Market saturation in social network service sector	Software agent enhancement
Need for innovative and differentiated features to compete with existing services Need for enhanced software agents for innovative products and services	Need for software agent enhancement	

As mentioned, the rapid growth of social network services in recent years has caused privacy issues (Debatin et al., 2009). According to Jamal (2013), interdisciplinary studies related to the privacy issues in social network services have built up the following four main themes:

- Users' information sharing behaviour (e.g., Gross and Acquisti, 2005; Acquisti and Gross, 2006; Fogel and Nehmad, 2009; Chen and Marcus, 2012; Wu et al., 2012);
- Correlations between demographics and privacy behaviour (e.g., Barnes, 2006; Lenhart and Madden, 2007; Pfeil, Arjan and Zaphiris, 2009);
- Users' privacy awareness (e.g., Govani and Pashley, 2005; Debatin et al., 2009; Litt, 2013; Stieger et al., 2013; Bryce and Fraser, 2014);
- Changes in privacy settings (e.g., Boyd and Hargittai, 2010; Kirk, 2010; Rothery, 2010; Tene, 2011; Chen and Marcus, 2012).

Since it was consistent with the review of privacy issues in the social network service environment and was also raised unanimously, this finding was a significant result which confirmed the research gap suggested in Sections 1.1.3 and 2.2.4.2.

#### ***Dilemma Between Networking and Privacy Concerns***

The majority of the stakeholders also suggested that the issue of the dilemma between networking and privacy concerns appears to be inevitable ( $N_B=5$ ,  $N_G=6$ ,  $N_C=6$ ).

*“I think the privacy issue is one of inevitable problems of social network services because of the nature of such services, which is sharing and socialising with others.” (Business)*

*“Social network service users already know that their information will be disclosed to public or to their friends (depends on their settings) because such services are designed to share information with each other to socialise.” (Government)*

*“I think it's impossible to be completely safe with one's information online when the purpose of social network services is 'networking' with others.” (Consumer)*

This issue is fundamentally caused by *quid pro quo*. For example, users disclose their personal information to other users within a service in exchange for the ability to see others' information and communicate with them. Moreover, social network services are usually based on the business model, in which services are free of charge in exchange for the ability to collect and analyse their personal information (Spinello, 2011). The businesses make profits by providing third-parties, namely advertisers, with the collected/analysed user information so that the third-parties can deliver targeted advertisements to



the users (Baym, 2011; Spinello, 2011). Government agencies, which are generally supposed to be interested in policy, also use personal information to pursue their own programmes (Morozov, 2013). For example, the Italian government is using a tool “redditometro” to examine a taxpayer’s expenditures in categories such as household costs, car ownership, vacations, gym subscriptions, mobile phone usage and clothing (Povoledo, 2013). The UK government’s Behavioural Insights Team, which was inspired by Thaler and Sunstein’s (2009) idea that “nudging” people’s behaviour based on collected/analysed personal information could help solve various problems such as obesity, climate change and drunk driving, was also featured by Jones, Pykett and Whitehead (2013).

#### ***Need for Rigorous Privacy Policy***

Given the aforementioned issues, the stakeholders suggested that stronger privacy policy or regulations would be necessary ( $N_B=7$ ,  $N_G=7$ ,  $N_C=7$ ).

*“In order to protect privacy, a strong and applicable privacy protection policy is essential.” (Business)*

*“Accompanying the change of the internet and social network service, endless concern and even more rigorous privacy policies will be required.” (Government)*

*“While there are more platforms for people to express themselves through technology, users will need more protection from unforeseen predators.” (Consumer)*

As mentioned, privacy infringement in the social network service environment has long a serious issue. Moreover, the issue has remained unattended due to the nature of social network services, in which users expose their highly personal information to their friends or even to strangers (Acquisti and Gross, 2006). In this sense, it is no wonder that the privacy infringement issue was identified. Thus, the privacy issues mentioned in Section 1.1.3 could be confirmed through the interview study. However, it would be impossible to stop people from using social network services simply because of privacy concerns. The fact that people use such services despite the real threat attests to their appeal. Therefore, rigorous implementations of privacy policy would still be beneficial for social network service users.

#### ***Proposition***

As there have been successive and numerous philosophical debates on privacy since the time of Aristotle, there is still confusion surrounding the meaning, value and scope of the concept of privacy (DeCew, 2013). Each social network service user may have different

perceptions and values of privacy (Power and Kirwan, 2015). Furthermore, what constitutes privacy infringement is still somewhat unclear. For example, users may want to disclose specific information only to a small group of close friends, but may want some other information to be known to strangers (Gross and Acquisti, 2005). Moreover, a single user would apply different privacy standards to his/her social network service use depending on his/her motivations to use different services. It also depends on the level of identifiability of the information, possible recipients and its possible uses (Gross and Acquisti, 2005). To implement rigorous privacy policy, therefore, it would be essential to possess not only fundamental knowledge of privacy but also how users perceive and value privacy and how their privacy standards differ depending on their motivations for service usage. Therefore, the first proposition is suggested as follows:

*Proposition 1: Detailed and comprehensive understanding of users' perceptions of privacy would be beneficial to implement rigorous privacy policy*

#### 3.2.2 User Type Recognition Algorithm for Software Agent Development

##### ***Difficulties in Providing Customised Services***

Assuming that the first proposition is fulfilled, it would be possible for businesses to provide consumers with customised services based on both individual perceptions of privacy and various standards of privacy policy for different service usage motivations. However, the majority of the stakeholders suggested that there has not been such an approach ( $N_B=5$ ,  $N_G=5$ ,  $N_C=6$ ).

*“We don't do anything to fulfil the diverse needs of each user type at the moment. I think it is impossible ... to consider each user's needs.” (Business)*

*“We don't apply separate policies. We apply all the same policies with the identical basis.” (Government)*

*“I don't think social network service providers recognise different types of users and provide customised service for different type of users at the moment.” (Consumer)*

According to Brandtzæg and Heim (2011), it would be useful for researchers, designers and managers to classify users into meaningful categories through a segmentation. As described in Section 2.1.3, there have been numerous studies on the typology of users in cyberspace (e.g., Kozinets, 1999; Nielsen, 2006; Ofcom, 2008; Brandtzæg and Heim, 2011). These studies, however, have primarily suggested that user typologies are based on user behaviour, indicating that it could be novel and beneficial if tailored services were

offered to the classified user types based on their perceptions of privacy. The detailed information of those classified user types could be created as “personas” (Cooper, 1999) to give clear representations of each user type.

#### **Software Agents for User Type Recognition**

What method could businesses use to understand the user types within social network services and offer them with customised services? The majority of the stakeholders suggested that it would be beneficial to design software agents in social network services to recognise the user types ( $N_B=5$ ,  $N_G=5$ ,  $N_C=6$ ).

*“Data such as gender, age, access time and usage time could be used for an automated analysis of usage patterns.” (Business)*

*“If there were reasonable and acceptable categorisations of user types in particular circumstances, it would be very beneficial to design the recommender systems from their point of view.” (Government)*

*“I think an automatic recognition system for different type of users with their social network service usage and followed by customised services for different types of users will fulfil the needs of users better than the more generalised services that social network service providers are offering at the moment.” (Consumer)*

The thing to consider in this argument is that it would be inevitable to develop an automated user type recognition system accompanied by some features such as monitoring-and-surveillance, data mining and autonomous nature. Ironically, these features are fundamental characteristics of software agents (Gilbert et al., 1995; Franklin and Graesser, 1996; Haag, Cummings and McCubbrey, 2004) as well as the factors that menace privacy. Zarsky (2013) claimed in his recent paper suggesting transparency of automated prediction systems that a non-interpretable process of data mining might elevate privacy risks, which is referred to as the “deficit of democracy” (Morozov, 2013).

#### **Proposition**

The issue of the dilemma between networking and privacy concerns discussed in Section 3.2.1 is in line with the dilemma between employing software agents and privacy concerns. On the one hand, a software agent is obviously a useful and effective technological tool given how many of users' daily activities occur within computing environments characterised by rapid change, large quantities of extraordinarily complex information and a lack of common organisational structures through which information may be accessed

and managed (Dowling, 2000). On the other hand, there have always been inevitable and potential hazards that are particularly related to privacy issues due to the monitoring-and-surveillance, data mining techniques and the autonomous nature of software agents (Haag, Cummings and McCubbrey, 2004; Bignell, 2005). The dilemma is thus whether the software agents will act in a correct and responsible manner in accordance with the users' objectives and if new methods of information dissemination and filtering are required to assist in a highly complex digital environment. Spinello (2011) also emphasised that services based on collected personal behavioural data have obvious risks of manipulation due to the possibility of "subtle exploitation of a user's needs and desires". Therefore, the "rigorous privacy policy" argued in Section 3.2.1 should be a prerequisite for the following second proposition:

*Proposition 2: Implementation of a user type recognition algorithm for software agent development would be beneficial to understand social network service users' perceptions of privacy and to provide them with customised services.*

#### 3.2.3 Need for Software Agent Enhancement

##### **Market Saturation in Social Network Service Sector**

The majority of the stakeholders emphasised the meaninglessness of another new service similar to existing and prominent ones such as Facebook ( $N_B=5$ ,  $N_G=4$ ,  $N_C=6$ ) and mentioned a need for innovative and differentiated competing services ( $N_B=3$ ,  $N_G=3$ ,  $N_C=4$ ).

*"From the users' point of view, there is no reason for them to choose the new services with the same features as Facebook because most people use Facebook." (Business)*

*"New services will have to offer users innovative and differentiated features in order to compete with existing services." (Government)*

*"I think it will be tougher to control and track abusers of social network services. We are embarking on a tougher area to control with growing technology use and accessibility, so many people will expect more and more new functions." (Consumer)*

It could mean that it is impractical to expect completely new and innovative services, namely market saturation, as one participant from the consumer stakeholder group answered:

*“It may not be economical, timely or reliable to research, hire and start new products/services to those offered by the social network company. Instead, hire/partner with/acquire a software agent to grow/maintain a happy customer base.”*

#### **Software Agent Enhancement**

The majority of the stakeholders endorsed the enhancement of software agents by mentioning their supportive and assistive traits ( $N_B=5$ ,  $N_G=4$ ,  $N_C=6$ ).

*“Software agents know what people need, and are constantly enhancing their functionality through machine learning.” (Business)*

*“Software agents do many tasks that users cannot do quickly or sometimes cannot do at all. I think that ‘Who viewed your profile’ on LinkedIn in particular is a unique feature to accelerate users’ network expansion.” (Government)*

*“A good software agent gives me my simple needs and keeps away any unwanted spam. I think they are good examples as I just like their simplicity.” (Consumer)*

As described in Section 2.1.2, Muntinga, Moorman and Smit (2011) enumerated six categories of users’ motivations for using social network services: entertainment, information, personal identity, remuneration, empowerment, and integration and social interaction. Each motivation can be subdivided into more detailed needs:

- **Entertainment:** Escaping or being diverted from problems or routine, emotional release or relief, relaxation, cultural or aesthetic enjoyment, passing time and sexual arousal;
- **Information:** Updating what events are occurring, searching for advice and opinions and reducing risks;
- **Personal identity:** Gaining insight into one’s self, reinforcing personal values and identifying with and gaining recognition from peers;
- **Remuneration:** Future rewards such as economic incentives, job-related benefits and personal wants like specific software;
- **Empowerment:** Enforcing service excellence to participate in online travel communities and reading political blogs to check whether broadcast media report events accurately;
- **Integration and social interaction:** Gaining a sense of belonging, connecting with friends, family and society, seeking emotional support and substituting real-life companionship.

Numerous social media, including social network services, are providing users with innovative services to fulfil various needs. Numerous services employing social networking features have thrived in recent years, and they are intricately woven and entangled (Figure 1.4). It may be possible to grasp the bigger picture of the contemporary social network service environment and to presume why all stakeholders mentioned the market saturation of social network services.

#### **Proposition**

The stakeholders suggested that it would be reasonable to investigate how to enhance software agents in social network services in terms of privacy protection rather than to suggest a new service model. Therefore, the third proposition is suggested as follows:

*Proposition 3: Enhancement of existing software agents in terms of privacy protection would be beneficial in the saturated social network service market.*

### **3.3 Summary**

The main goal of the study was to comprehend stakeholders' perspectives on the social network service environment through qualitative interview research in order to identify possible needs to consider in software agent design. Twenty-one stakeholders belonging to three key stakeholder groups were interviewed. Three main categories emerged from the collected data: comprehensive understanding of users' perceptions of privacy; user type recognition algorithm for software agent development; and existing software agent enhancement. Three theoretical propositions were identified based on the qualitative content analysis approach:

1. Detailed and comprehensive understanding of users' perceptions of privacy would be beneficial to implement rigorous privacy policy.
2. Implementation of a user type recognition algorithm for software agent development would be beneficial to understand social network service users' perceptions of privacy and to provide them with customised services.
3. Enhancement of existing software agents in terms of privacy protection would be beneficial in the saturated social network service market.

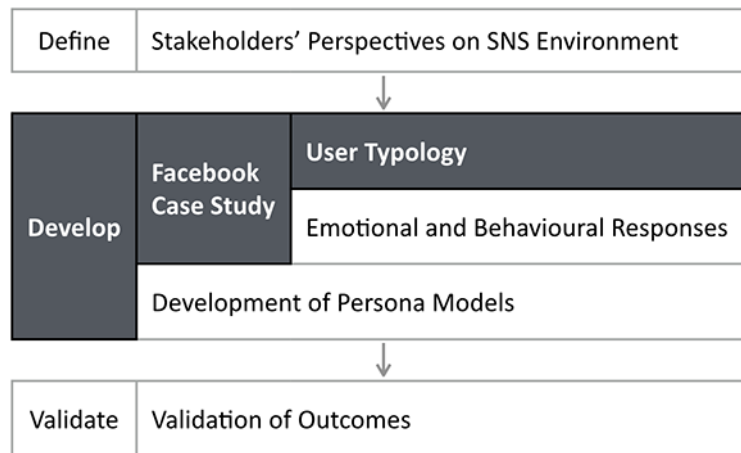
Synthesising the above propositions, the opinions of stakeholders regarding the current situation and possible future of social network services were suggested as follows:

*Prospective users of social network services would need an enhanced software agent in terms of privacy protection. To achieve this, it is important to have an in-depth*

*understanding of the variations in the personal perceptions of privacy that occur for different user categories.*

Therefore, it would be beneficial to empirically investigate social network service users while interacting with the services or software agents. This would help to identify the detailed attributes and factors that affect user perceptions of privacy, user type recognition and software agent ability in social network services.

## Chapter 4. Facebook Case Study Part 1: Social Network Service User Typology



In Chapter 3, the following statement was defined through the qualitative interview study of the stakeholders' perspectives on the social network service environment:

*Prospective users of social network services would need an enhanced software agent in terms of privacy protection. To achieve this, it is important to have an in-depth understanding of the variations in the personal perceptions of privacy that occur for different user categories.*

Based on the statement, the study aimed to explore how software agents might be enhanced in terms of privacy protection. In order to achieve this goal, the following two research hypotheses were established: (1) Social network service users can be classified into categories according to their perceptions of privacy, and (2) The classified user types would be expected to respond differently in specific privacy infringement situations. Exploring the two hypotheses will help to explain users' perspective towards privacy issues in social network services, which would improve the ability of software agents to provide privacy protection.

As there were two research hypotheses, the study consisted of two parts. This chapter focuses on the first part: how social network service users are classified into categories according to their perceptions of privacy, namely social network service user typology. The next chapter focuses instead on the main differences between the different user groups in identical situations of privacy infringement.

As discussed in Sections 2.1.3 and 3.2.2, previous efforts to classify social network service users into categories (e.g., Kozinets, 1999; Nielsen, 2006; Ofcom, 2008; Brandtzæg and Heim, 2011) were often based on users' behaviour within the services. Tailoring services to



the classified user types based on their perceptions of privacy could thus be a novel idea. Therefore, the main goal of this chapter was to explore by means of a case study how social network service users can be classified into meaningful categories by their perceptions of privacy.

## 4.1 Study Design

### 4.1.1 Case Study: Facebook

A case study refers to “an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, programme or system in a ‘real life’ context” (Simons, 2009). According to Yin (2014), a case study method would be preferred particularly when a researcher has little or no control over events and when the research focus is a contemporary phenomenon. In addition, the case study also has the advantage of gaining a full image of the phenomenon and grasping analytical insights from it.

The case study can be either single or multiple. A single case study is usually selected if the case is unusually revelatory, an extreme exemplar or an opportunity for unusual research access (Yin, 2014). Therefore, a single case study is conducted to explore significant phenomenon in unusual or extraordinary environments (Eisenhardt and Graebner, 2007). On the other hand, multiple case studies are often selected when an emergent finding is not idiosyncratic to a single case but rather replicated repeatedly by several cases (Eisenhardt, 1991). Therefore, multiple case studies usually offer robust, generalisable and testable theories through varied empirical evidence for theory building (Eisenhardt, 1991; Yin, 2014).

Since the study intended to explore social network service users’ perceptions of privacy in several privacy infringement situations in a specific service, the case study was considered an appropriate research method. Considering the following criteria, Facebook (<http://www.facebook.com>) was chosen as an appropriate service for the study:

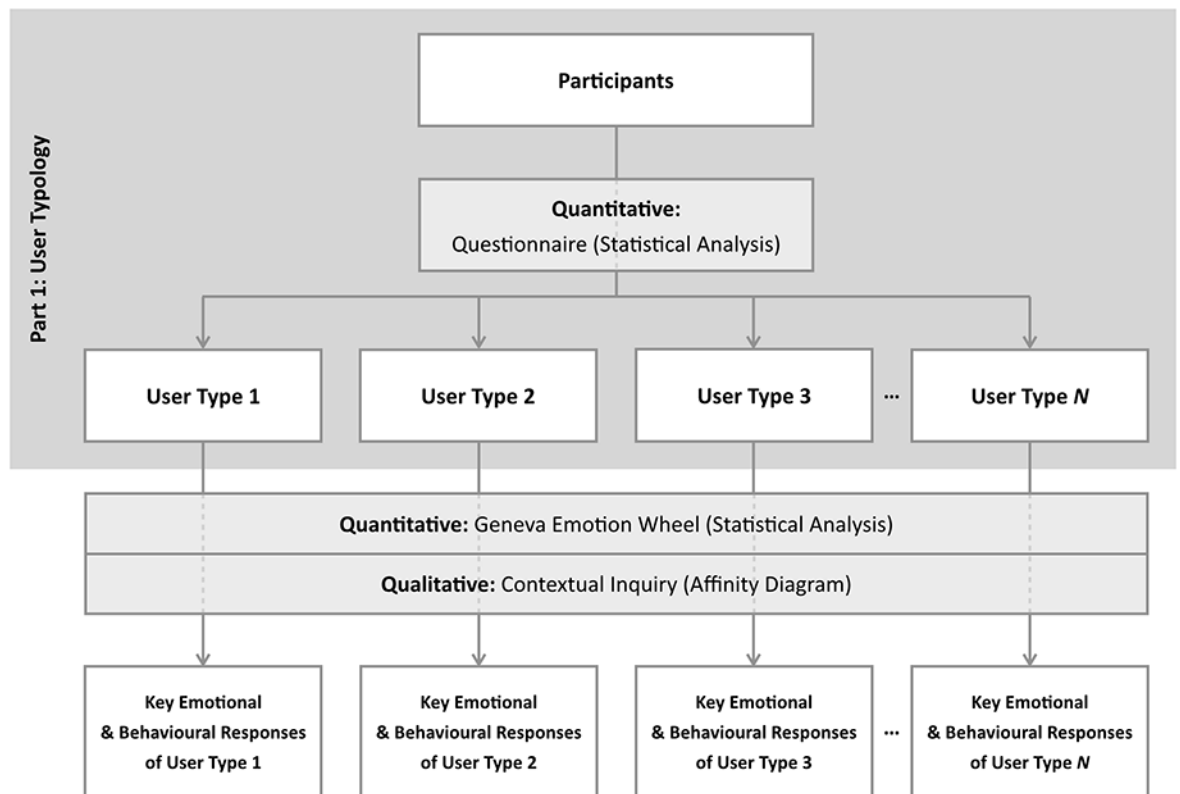
- **The largest global service:** Facebook had over one billion monthly active users worldwide in 2013 (Facebook, 2013). Moreover, choosing one of the global services would be appropriate to avoid possible cultural bias of domestic/local services.
- **Profile-based service:** As explained in Section 2.1.1, the profile is a key aspect of social network services. One of distinguishing features of Facebook is that users create their profiles with accurate and personally identifiable information to communicate with real world friends (Dwyer, 2007; Krishnamurthy and Wills,

2010), which makes Facebook an interesting case for privacy research (Bonneau et al., 2009).

- **Service used for social connections:** Facebook users' social activities are usually related to connecting with friends and family, creating groups and creating pages. The estimated number of transactions (or interactions) on Facebook was 13 million per second in 2011 (Catanese et al., 2011). Given the figure, a service often used for social connections could be potentially at high risk of privacy infringement.
- **Service using an opened platform:** According to the Facebook report (2013), nine million apps and websites are integrated into Facebook, users install 20 million applications every day and 80% of businesses are represented on Facebook accumulating ad revenue of \$2.16 billion in the United States. Given these figures, a service using an opened platform could be potentially at higher risk of privacy infringement than a service using a closed one.

#### 4.1.2 Research Approach

According to Aldenderfer and Blashfield (1984), classification is not only a fundamental conceptual activity, but also an essential procedure and basis of the development of theories within a science. A widely used classification procedure involves empirically collecting information on the several specific factors to form “clusters” through a multivariate statistical procedure (Aldenderfer and Blashfield, 1984). In other words, the clustering method is used to reorganise the sample into relatively homogeneous groups of highly similar entities through a quantitative approach. In terms of the study described in this chapter, it was considered possible to find homogeneous groups of highly similar entities by collecting quantitative data of some variables related to the social network service users' perceptions of privacy and analysing the data using the multivariate statistical procedure. Therefore, this chapter investigates how social network services users can be classified into meaningful categories by their perceptions of privacy through a quantitative approach (Figure 4.1).



[Figure 4.1] Research framework: Facebook case study part 1

### 4.1.3 Measures

#### *Participant Profiling*

The participant profiling included (1) the socio-demographics of gender, age and nationality and (2) the social network service prior usage experience.

#### *User Typology Measure Based on Previous Study*

The user typology measures of Brandtzæg and Heim (2011) were adopted because of the recentness of publication and thoroughness of review of previous classification schemes. A single question, “What are your main reasons for visiting Facebook?” was asked to the participants, followed by 17 yes/no alternatives reflecting different modes of communication (informational vs. recreational) and levels of participation (high vs. low) (Table 4.1).

[Table 4.1] Yes/no alternatives reflecting different modes of communication and levels of participation (Source: Brandtzæg and Heim, 2011)

17 Yes/No Alternatives	
1. To write a contribution	10. To make appointments
2. To find an announcement for an event	11. To look for new information
3. To publish or share pictures	12. To write letters or messages
4. To publish or share audio/music	13. To discuss
5. To publish or share film/video	14. To run community groups
6. To see if somebody has tried to contact me	15. To surf others' profiles
7. To look for a new friend	16. To contact others
8. To read new contribution	17. To kill some time
9. To see other people's pictures/videos	

### ***User Typology Measure Based on Perceptions of Privacy***

The questionnaire comprised 16 statements related to privacy awareness, privacy behaviour, trust attitude and trust behaviour adopted from O'Brien and Torres (2012) (Table 4.2).

[Table 4.2] The questionnaire statements related to privacy awareness, privacy behaviour, trust attitude and trust behaviour (Source: O'Brien and Torres, 2012)

Category	Definition	Item	Statement
Privacy Awareness	Users' awareness of activities concerning privacy on Facebook	PP1	My name and profile picture on Facebook are not protected under the privacy settings.
		PP2	Whenever I share information on Facebook, I can control exactly who can see it.
		PP3	Information set to 'everyone' on Facebook in the privacy settings is available to everyone on the Internet, not just Facebook users.
		PP4	Using the games and applications means I am making my information available to someone other than Facebook.
		PP5	My friends' activities on Facebook can result in my information being made available to other companies and websites.
		PP6	Facebook does not share information with third parties.
Privacy Behaviour	The influence of privacy on users' online behaviour	PP7	I am cautious in what I say and do on Facebook.
		PP8	I do not think about privacy issues when online.
Trust Attitude	Users' attitude towards trust on Facebook	PP9	I trust Facebook with my information.
		PP10	I trust my Facebook friends with my information.
		PP11	I trust friends of friends with my information.
		PP12	I trust other Facebook users with my information.
Trust Behaviour	Users' behaviour influenced by trust on Facebook	PP13	Trust issues are likely to cause Facebook users to question what they say and do on Facebook.
		PP14	Trust issues are likely to cause Facebook users to change what they say and do on Facebook.
		PP15	It is my responsibility to protect my information on Facebook.
		PP16	It is Facebook's responsibility to protect my information on Facebook.

These statements were considered to be appropriate for the study as they were carefully generated by O'Brien and Torres (2012) after reviewing the literature and adopting the questions from influential preceding studies by Govani and Pashley (2005) and Gross and Acquisti (2005). O'Brien and Torres (2012) extracted the statements from Facebook's privacy policy and Facebook users' focus group discussion, meaning that the statements would be appropriate for the Facebook case study.

The rating scales were six-level Likert scales (from strongly disagree to strongly agree). Although Likert scales are often considered the ordinal level of measurement and treating Likert scales as interval scales has long been controversial (Jamieson, 2004; Norman, 2010), it was presumed that the intervals between values were equal in order to analyse data by parametric test methods, if applicable.

#### **4.1.4 Sampling and Data Collection Procedure**

Prior to recruiting participants and collecting data, the research ethics approval was applied for and granted by the University Research Ethics Committee. Initial invitations were sent to Brunel University London students to ask them to reply if they were interested in participating in the study. The profiling and Brandtzæg and Heim's (2011) user type identification questions were then sent to potential participants. At this stage, a purposive sampling strategy, one of the non-probability sampling methods to select participants relevant to the research topic area (David and Sutton, 2011), was employed to confirm the appropriateness of the potential participants. Participants must have used three or more social network service accounts and Facebook for over five years to be part of the sample. Consequently, six potential participants were disqualified by these criteria, and a total of 50 participants were recruited. The recruited participants (Male: 21, Female: 29) ranged in age from 24 to 47 and were from various countries (e.g., Brazil, Canada, China, Germany, Italy, South Korea, Taiwan, Thailand, UK). Although there might have been potential limitations of using only Brunel University London students as participants, it was considered that this sample could avoid biased results due to the following reasons:

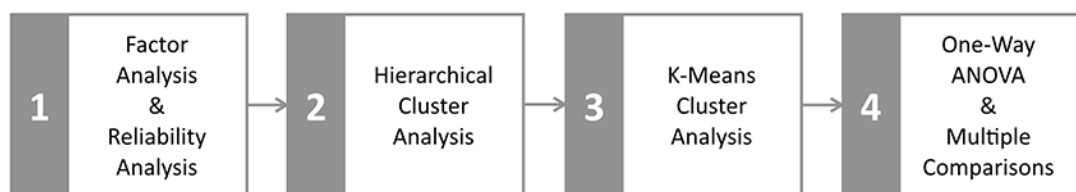
- Similar proportion of males to females;
- Various age groups;
- International students from various countries.

Data were collected from April to May 2014 through individual hour long sessions. After welcoming participants and explaining the procedure, participants were asked to sign the informed consent form and to answer the questionnaire about their perceptions of privacy for 15 minutes in the first part of the case study. The details of the second part will be explained in Chapter 5.

### 4.1.5 Data Analysis

To classify the participants into groups, a cluster analysis method using IBM SPSS Statistics 22 (Burns and Burns, 2008; Hair et al., 2010; Pallant, 2010; Mooi and Sarstedt, 2011; Green and Salkind, 2012) was conducted. According to Gore (2000), cluster analysis is a useful statistical procedure for classifying objects into groups based on multivariate similarity. It is often used in various fields of study such as life science (life form, chemical or cell groups), medical science (symptom or disease groups), behavioural science, psychology and economy. Given the research hypothesis, cluster analysis was considered appropriate to determine similarities among social network service users' perceptions of privacy.

The purpose of the cluster analysis is to partition a sample into homogeneous categories to create an operational classification (Burns and Burns, 2008), which means that the cases in a specific cluster share several common characteristics but are very dissimilar between the cases (Mooi and Sarstedt, 2011). There are two major approaches of cluster analysis — hierarchical cluster analysis and non-hierarchical cluster analysis (usually k-means cluster analysis) (Burns and Burns, 2008; Mooi and Sarstedt, 2011). In general, k-means cluster analysis is the most widely employed technique for clustering. However, k-means cluster analysis lacks some validity due to the inevitable researcher subjectivity when deciding the number of clusters (Mooi and Sarstedt, 2011). One way to avoid the limitation, suggested by Burns and Burns (2008), is to conduct both the hierarchical and the k-means techniques successively. In particular, hierarchical technique is used to determine an optimum number of clusters. Then another clustering is conducted with the determined number in which to place all the cases with the k-means clustering. Figure 4.2 presents the statistical analysis framework applied in the study to classify the participants into groups.



[Figure 4.2] Statistical analysis framework: Classifying participants into groups

#### **Factor Analysis & Data Analysis**

Factor analysis is a statistical analysis method widely employed in social science research in order to extract latent factors based on the underlying correlations among observed variables (Hair et al., 2010). The principal component analysis method was employed to extract a set of latent factors (Pallant, 2010), and the varimax rotation method was used to enhance the interpretability and scientific utility of the solution (Hair et al., 2010).

After factor analysis, reliability analysis is often conducted to estimate the degree to which the set of indicators on a latent construct is internally consistent (Hair et al., 2010). In other words, reliability analysis assesses whether the measures of the extracted latent factors yield consistent scores across administrations (Green and Salkind, 2012). Cronbach's alpha value, which evaluates the consistency of the entire scale (Hair et al., 2010), was determined to confirm the factors' reliability coefficient. Values above 0.70 were considered significant (Hair et al., 2010).

#### ***Hierarchical Cluster Analysis***

A hierarchical cluster analysis was conducted to determine the appropriate number of clusters using Ward's method (Ward, 1963), a procedure commonly used for forming hierarchical groups when expecting equally sized clusters (Mooi and Sarstedt, 2011).

#### ***K-Means Cluster Analysis***

A k-means cluster analysis was performed using the number of clusters as found to be optimal from the hierarchical cluster analysis (Burns and Burns, 2008).

#### ***One-Way ANOVA & Multiple Comparisons***

After the clustering procedure, one-way ANOVA and multiple comparisons were conducted to determine which classifying variables are significantly different between the groups (Green and Salkind, 2012).

## **4.2 Results**

### **4.2.1 Factor Analysis and Reliability Analysis**

#### ***Factor Analysis***

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.767, which is considered "good" (Kaiser, 1974; Hutcheson and Sofroniou, 1999; Field, 2009). The Bartlett's test of sphericity was highly significant ( $p < 0.001$ ), which confirms that the correlation matrix is an identity matrix (Hair et al., 2010). Taken together, it was possible to confirm that the collected dataset was appropriate for factor analysis (see Appendix B.1, p. 197).

Examining eigenvalues is an initial method in principal component extraction to determine how many factors can be extracted. Values above 1.00 are considered significant (Hair et al., 2010; Pallant, 2010). Looking into the total variance explained, the first three factors showed the eigenvalues above 1.00. The scree plot, which is a line segment plot commonly used to determine the optimum number of factors (Hair et al., 2010), also showed that the eigenvalues in the first three columns were above 1.00, and the line was almost flat after the third factor (see Appendix B.1, p. 197). Given the eigenvalues and the scree plot, the 16 items were newly classified into three factors in this study. Since the number of categories has changed, the statements of each item presented in Table 4.2 were regrouped according to the new three factors. Based on the keywords of the statements, the three factors were then newly labelled as follows: (1) privacy awareness, (2) trust/carelessness and (3) responsibility.

[Table 4.3] Summary of factor analysis and reliability analysis

Item	Factor Analysis				Reliability Analysis	
	Factor Loadings			Communality	Alpha if Item Deleted	Cronbach's Alpha
	Privacy Awareness	Trust/Carelessness	Responsibility			
PP5	<b>0.903</b>	-0.244	0.208	0.918	0.832	<b>0.845</b>
PP6_R	<b>0.876</b>	-0.156	0.311	0.889	0.830	
PP3	<b>0.797</b>	-0.100	0.509	0.905	0.822	
PP4	<b>0.721</b>	0.284	0.320	0.703	0.835	
PP2	<b>0.663</b>	-0.367	0.577	0.908	0.833	
PP1	<b>0.651</b>	0.079	0.621	0.816	0.837	
PP12	-0.097	<b>0.905</b>	0.244	0.887	0.816	<b>0.831</b>
PP8	0.165	<b>0.892</b>	-0.111	0.835	0.818	
PP9	0.131	<b>0.888</b>	-0.011	0.807	0.817	
PP10	-0.211	<b>0.887</b>	0.219	0.880	0.811	
PP11	-0.317	<b>0.854</b>	0.145	0.851	0.816	
PP7_R	-0.060	<b>0.792</b>	-0.164	0.658	0.831	
PP15	0.310	-0.072	<b>0.905</b>	0.920	0.825	<b>0.848</b>
PP13	0.202	0.161	<b>0.880</b>	0.841	0.842	
PP16_R	0.361	0.067	<b>0.862</b>	0.878	0.825	
PP14	0.509	0.153	<b>0.752</b>	0.848	0.836	
Eigenvalue	4.332	4.922	4.290			
% of Variance	27.075	30.761	26.810			



### **Reliability Analysis**

The Cronbach's alpha values of each factor were found to be above 0.70 (Privacy Awareness: 0.845, Trust/Carelessness: 0.831 and Responsibility: 0.848) (see Appendix B.1 for the complete results, p. 198). Table 4.3 presents the summary of the factor analysis and reliability analysis.

#### **4.2.2 Hierarchical Cluster Analysis**

A hierarchical cluster analysis was conducted to determine the appropriate number of clusters based on the three factors of privacy awareness, trust/carelessness and responsibility. The dendrogram, a tree graph representation that shows how the clusters are combined at each step (Hair et al., 2010), revealed that either two or four clusters could be optimum to acquire equally sized clusters. The scree plot suggested that the change of coefficient drastically decreased from the fourth cluster and that the line was almost flat after four clusters. Taken together, the optimum number of clusters was determined to be four (see Appendix B.1, p. 199).

#### **4.2.3 K-Means Cluster Analysis**

A k-means cluster analysis was performed using four clusters as found to be optimal from the hierarchical cluster analysis. The result of the k-means clustering was 13 people in cluster 1, 12 in cluster 2, 13 in cluster 3 and 12 in cluster 4.

The five user types from Brandtzæg and Heim's (2011) typology defined by users' participation level and focus of activities were now classified into four user types based on the users' perceptions of privacy. Inspection of the location of a given individual in each classification system suggested a partial correlation since there were dominant numbers of participants of each user type (except "actives") in each of the new classifications. In particular, seven sporadics were assigned to cluster 1, seven socialisers to cluster 2, eight debaters to cluster 3 and six lurkers to cluster 4 (Table 4.4).

[Table 4.4] Comparisons between old and new user typology

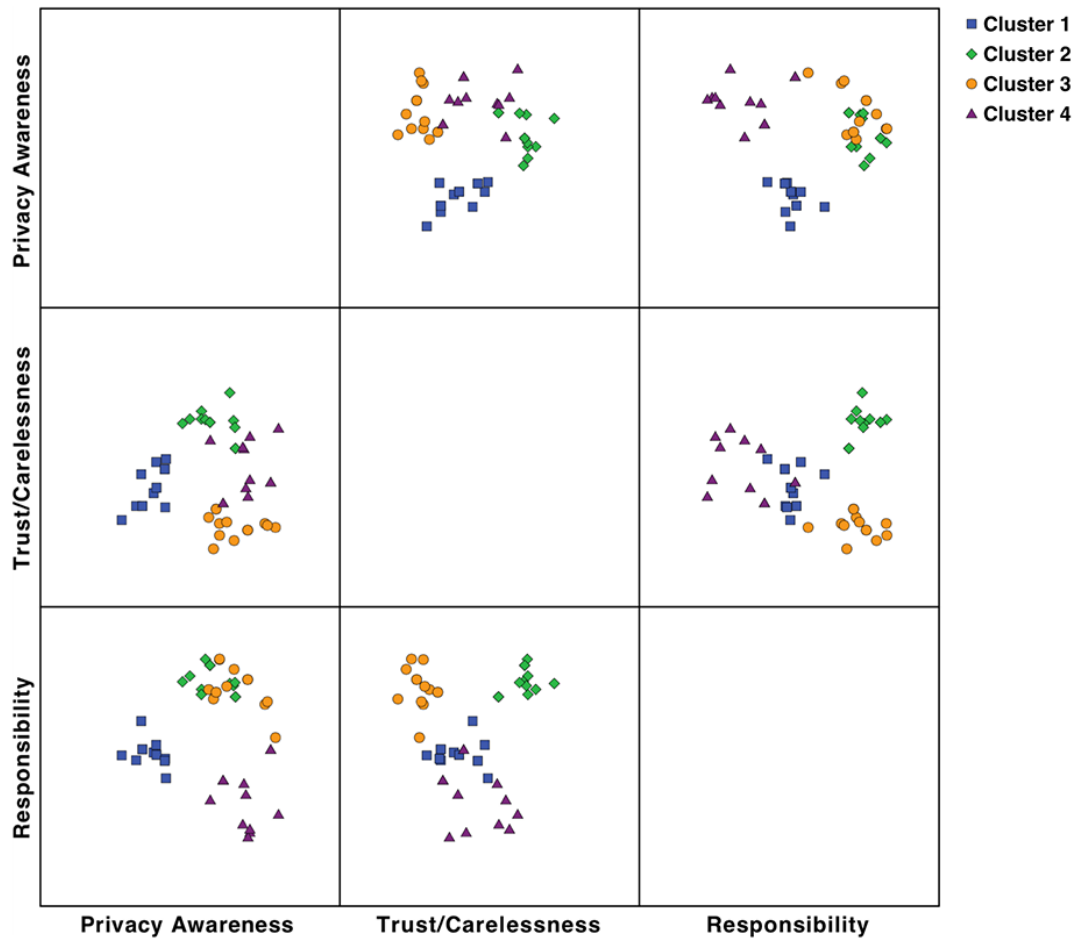
	<b>Cluster 1 (N = 13)</b>	<b>Cluster 2 (N = 12)</b>	<b>Cluster 3 (N = 13)</b>	<b>Cluster 4 (N = 12)</b>
<b>Sporadic (N = 10)</b>	7			3
<b>Lurker (N = 10)</b>	4			6
<b>Socialiser (N = 10)</b>		7	1	2
<b>Debater (N = 10)</b>		2	8	
<b>Active (N = 10)</b>	2	3	4	1

The final cluster centres (Table 4.5) indicate that cluster 1 has very low values for “privacy awareness”. Cluster 2 has very high values for “trust/carelessness” and “responsibility”. Cluster 3 has very high values for “privacy awareness” and “responsibility”, but very low values for “trust/carelessness”. Cluster 4 has very high values for “privacy awareness”, but very low values for “responsibility”.

[Table 4.5] Final cluster centres (*Note.* Very low values are in italic, average values are in regular and very high values are in bold.)

	<b>Cluster 1 (N = 13)</b>	<b>Cluster 2 (N = 12)</b>	<b>Cluster 3 (N = 13)</b>	<b>Cluster 4 (N = 12)</b>
<b>Privacy Awareness</b>	<i>-1.423</i>	0.075	<b>0.576</b>	<b>0.843</b>
<b>Trust/Carelessness</b>	-0.240	<b>1.321</b>	<i>-1.149</i>	-0.183
<b>Responsibility</b>	-0.451	<b>0.934</b>	<b>0.799</b>	<i>-1.310</i>

Figure 4.3 presents the scatter plot matrix that shows how each cluster member is positioned on the two-dimensional graph with respect to all the input variables (Hair et al., 2010). Each row and column presents a single scatter plot with respect to the two variables selected from the row and column respectively.



[Figure 4.3] Scatter plot matrix

#### 4.2.4 One-Way ANOVA & Multiple Comparisons

Table 4.6 presents the summary of the mean comparison statistical analysis (see Appendix B.1 for the complete results, p. 201). The differences between group means were all significant ( $p < 0.05$ ), indicating that each of the three variables reliably distinguished between the four clusters. Post hoc multiple comparisons revealed the following:

- “Privacy awareness” differentiates clusters 3, 2 and 1, and clusters 4, 2 and 1. Clusters 3 and 4 are not significantly different on this variable.
- “Trust/carelessness” differentiates clusters 2, 1 and 3, and clusters 2, 4 and 3. Clusters 1 and 4 are not significantly different on this variable.
- “Responsibility” differentiates clusters 2, 1 and 4, and clusters 3, 1 and 4. Clusters 2 and 3 are not significantly different on this variable.

[Table 4.6] Summary of mean comparisons and post hoc multiple comparisons

Factor	Cluster	Mean	F	Sig.	Post Hoc
Privacy Awareness	1	-1.423	61.722	0.000	3 = 4 > 2 > 1
	2	0.075			
	3	0.576			
	4	0.843			
Trust/ Carelessness	1	-0.240	121.883	0.000	2 > 1 = 4 > 3
	2	1.321			
	3	-1.149			
	4	-0.183			
Responsibility	1	-0.451	98.735	0.000	2 = 3 > 1 > 4
	2	0.934			
	3	0.799			
	4	-1.310			

## 4.3 Discussion

### 4.3.1 Four User Types Based on Perceptions of Privacy

As mentioned in Section 4.2.4, not every factor showed statistically a significant difference in each cluster. For example, “privacy awareness” did not show a statistically significant difference between clusters 3 and 4, “trust/carelessness” between clusters 1 and 4, or “responsibility” between clusters 2 and 3. Therefore, based on the final cluster centres presented in Table 4.5, the factors that exhibited very high or very low values in each cluster were used as the source of the semantic name assigned to the cluster. The following sections present brief descriptions of the characteristics and names of the four clusters.

#### ***Uninformed (N = 13)***

Cluster 1 is characterised by an extreme lack of awareness of privacy practice. This cluster was thus assigned the name “uninformed”.

As presented in Table 4.2, “privacy awareness” is defined as users’ “awareness of activities concerning privacy” (O'Brien and Torres, 2012) on Facebook. Social network service users’ different patterns of behaviour due to their different privacy awareness can be often found in their information disclosure. For this reason, numerous scholars have explored social network service users’ information disclosure patterns through case studies (e.g.,

Govani and Pashley, 2005; Gross and Acquisti, 2005; Kolek and Saunders, 2008; Nosko, Wood and Molema, 2010; Tow, Dell and Venable, 2010).

Acquisti and Gross (2006) have claimed that privacy awareness is affected by users' frequency of updates, thus that privacy awareness gradually increases with time and experience. Given this characteristic, most newcomers could be considered "uninformed" users because they would inevitably have the least experience in using Facebook compared to other users.

#### ***Trustful (N = 12)***

Cluster 2 is characterised by highly trusting others and thus being very careless about privacy. This cluster was thus assigned the name "trustful". In addition, these users are more aware of the privacy practices than "uninformed" users are.

It might be impossible to discuss privacy issues in social network services without "trust". In an interpersonal context, "trust" is defined as "an expectancy held by an individual or a group that the word, promise, verbal or written statement of another individual or group can be relied upon" (Rotter, 1967). Deutsch (1973) also defined trust as "confidence that one will find what is desired from another, rather than what is feared". According to Boyd and Ellison (2007), the core concept of social network services is not only building connections with existing contacts, but also instigating relationships with new contacts in an online environment. In other words, the focus of a social networking environment places great emphasis on openness and sharing information. According to Metzger (2004) and Van Dyke, Midha and Nemati (2007), however, trust is often affected by privacy concerns; thus, high privacy concern (i.e., cautiousness) might consequently restrict individual willingness to transact or interact online with others. Therefore, trust is generally in inverse proportion to cautiousness.

In the Oxford Dictionary of English (2010), "responsibility" is defined as "the state or fact of having a duty to deal with something or of having control over someone". Therefore, "responsible for information protection" would mean that social network service users have a duty to protect their own personal information in cyberspace. Mitrano (2006) also emphasised that the idea of individual responsibility for information protection is critical in social network services. As both clusters 2 and 3 revealed very high responsibilities, they might be diligent in personal information protection.

Given the characteristics, "trustful" participants are the highest in trusting others on Facebook and in being responsible for information protection. This suggests that these

participants might be the keenest among the four user types on using Facebook as well as on actively managing their own personal information.

#### ***Suspicious (N = 13)***

Cluster 3 is characterised by being suspicious of others and cautious about privacy. This cluster was thus assigned the name “suspicious”. Like “trustful” participants, “suspicious” participants were highly responsible for information protection. For some reason, “suspicious” participants were least likely to trust others on Facebook. They use the service less frequently than “trustful” participants, and carefully and actively manage their own personal information.

#### ***Neglectful (N = 12)***

Cluster 4 is characterised by being somewhat aware of privacy practices but irresponsible concerning information protection. This cluster was thus assigned the name “neglectful”. Given the characteristics, most of adept but inactive users might belong to this type, as they would have the most experience in using Facebook, which could result in the highest “privacy awareness” among the four user types. Interestingly, however, this cluster was the least responsible for information protection, meaning that they might dislike Facebook and neglect to protect personal information.

### **4.3.2 Comparison Between Different Models of User Types**

For purposes of comparison, Table 4.7 presents the user types defined in the current study alongside the main similar online user types of Kozinets (1999), Nielsen (2006), Ofcom (2008) and Brandtzæg and Heim (2011).

Kozinets’ (1999) typology is a classification concerned with marketing and product consumption or the provision of information about products inside online communities rather than social network services. Nevertheless, Kozinets’ (1999) typology is very similar to Brandtzæg and Heim’s (2011) typology, meaning that the results of this study could be closely connected to it as well. For example, common points between the two typologies might be the strong social ties of “trustful” users and minglers; the few social attachments of “suspicious” users and devotees; and the superficial interest and limited social ties of “neglectful” users and tourists. Insiders could be those who have both strong social ties and strong interest in consumption activity, which means that these categories have high levels of participation. Thus, they are likely to be included in both “trustful” and “suspicious” types.

[Table 4.7] Comparison between different user typologies (*Note.* Categories given in brackets indicate that only minorities are included.)

User Type				
<b>Kozinets (1999)</b>		Minglers (and insiders)	Devotees (and insiders)	Tourists
<b>Nielsen (2006)</b>		Intermittent/heavy contributors		Lurkers
<b>Ofcom (2008)</b>	Alpha socialisers and followers	Faithfuls (and attention seekers)	Functionals (and attention seekers)	
<b>Brandtzæg and Heim (2011)</b>	Sporadics	Socialisers (and actives)	Debaters (and actives)	Lurkers
<b>This Study</b>	Uninformed	Trustful	Suspicious	Neglectful
<b>Justification</b>	Newcomers and sporadic users	Actively interchange with other users which accounts for strong social ties and trust	Highly interested in information more than social attachments	Superficial participation and very few social ties

Nielsen's (2006) typology may be related to the three new user types excluding the "uninformed" type. Intermittent contributors and heavy contributors are unlikely to be divided into two groups according to the level of trust; rather, they were classified based on the contribution level regardless of their participation mode. However, it may be possible to include them together in both "trustful" and "suspicious" types. In addition, lurkers who are non-contributing and resource-taking members may be connected to the "neglectful" type because they are similar in terms of their low level of participation and very few social ties.

Ofcom's (2008) typology may be connected to the three new user types excluding the "neglectful" type. In particular, alpha socialisers and followers may be related to "uninformed" users as they visit social network services for short bursts or to maintain connections with peers, indicating that they could be newcomers or sporadic users. Faithfuls, who often rekindle old friendships, may be connected to "trustful" users because of the socialising aspect. Functionals, who log on for purposes other than socialising, may be connected to "suspicious" users because of the informational mode of participation. Finally, attention seekers who seek comments from others through posting actively — either recreational or informational — may be connected to both "trustful" and "suspicious" users, who have a high level of participation.

Compared to the Brandtzæg and Heim's (2011) typology, the new user typology may be closely related to the four user types excluding actives, who were included among both "trustful" and "suspicious" types, who were also high in the participation level. Given the differences in the classification basis between the two typologies, the participation mode and level appear to be related to users' perceptions of privacy. For example, sporadics, who are mostly newcomers, would be related to "uninformed" users; socialisers with strong

social ties would be related to “trustful” users; debaters with distinct informational modes would be related to “suspicious” users, who are very cautious about privacy; and lurkers with a low participation level would be related to “neglectful” users, who pay little attention to their accounts.

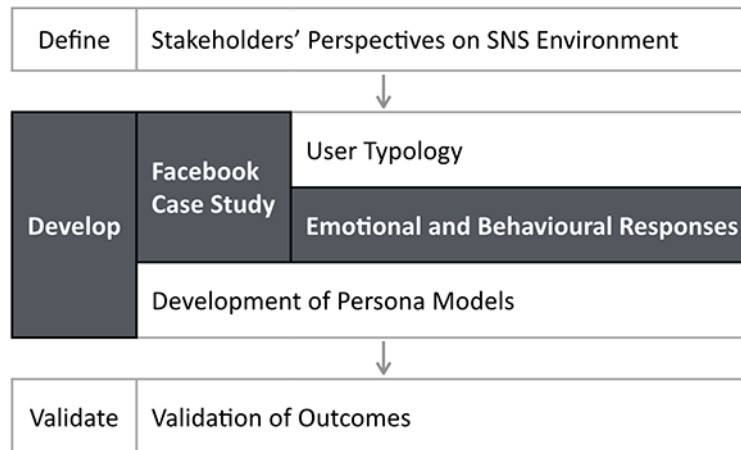
### **4.4 Summary**

This chapter has dealt with the first part of the Facebook case study, which aimed to explore how the software agent might be enhanced in terms of privacy protection. The first part of the case study focused on the user typology by identifying how Facebook users could be classified according to their perceptions of privacy. Fifty participants were classified into four distinct user types — uninformed, trustful, suspicious and neglectful — which reflect different levels of privacy awareness, trust/carelessness and responsibility. By revealing the distinct characteristics of the four user types, the differences in perceptions of privacy were suggested, followed by the new typology’s theoretical implications comparing them with the previous user typology models.

The next chapter presents the second part of the Facebook case study, which explores how the classified user types respond differently in several privacy infringement situations.



## Chapter 5. Facebook Case Study Part 2: Social Network Service Users' Emotional and Behavioural Responses



This chapter deals with the second part of the Facebook case study. The research hypothesis was that the classified user types would respond differently in specific privacy infringement situations. The activities described in this thesis were motivated by the research gap that relatively few studies have focused on practical approaches to proposing solutions to privacy issues based on users' instant non-verbal responses in social network services. A human centred design approach was considered one possible method to fill the research gap. The principles of human centred design presented in Section 2.3.2 give weight to the significance of understanding and empathising with users, and providing them with a collaborative and quality experience. Therefore, the study described in this chapter investigated users' emotional and behavioural responses, as suggested in Section 1.1.3.

### ***Why Emotional Response?***

In the Oxford Dictionary of English (2010) the word "emotion" is defined as "a strong feeling deriving from one's circumstances, mood, or relationships with others". In psychology, an emotion is defined as "a complex psychological state that involves three distinct components: a subjective experience, a physiological response, and a behavioural or expressive response" (Hockenbury and Hockenbury, 2007).

According to Fox (2008), emotions are temporary and contain a coordinated set of responses, which may include verbal, physiological, behavioural and neural mechanisms. The processing model of emotion suggested by Scherer (2005) includes the following five crucial elements of emotion:

- **Cognitive appraisal:** provides an evaluation of events and objects;
- **Bodily symptoms:** the physiological component of emotional experience;
- **Action tendencies:** a motivational component for the preparation and direction of motor responses;
- **Expression:** facial and vocal expression almost always accompanies an emotional state to communicate reaction and intention of actions;
- **Feelings:** the subjective experience of emotional state once it has occurred.

In affective neuroscience, there are a number of similar constructs that can be differentiated from emotion as follows (Fox, 2008):

- **Feelings** are best understood as a subjective representation of emotions, private to the individual experiencing them.
- **Moods** are diffuse affective states that last longer but are less intense than emotions.
- **Affect** is an encompassing term used to describe emotion, feelings and moods together, even though it is commonly used interchangeably with emotion.

Studies on basic emotions date back over 40 years. Influenced by Darwin's (1872) theory that human emotions are biologically determined and universal to human culture, Ekman (1972) studied facial expressions of emotions in different cultures and suggested six basic emotions of rapid onset and short duration: anger, disgust, fear, happiness, sadness and surprise. In the late 1990s, Ekman (1999) added the following emotions to the list: amusement, contempt, contentment, embarrassment, excitement, guilt, pride in achievement, relief, satisfaction, sensory pleasure and shame, but stated that not all of these can be encoded via facial expressions. Similarly, Griffiths (1997) suggested that there are emotions involving greater amounts of cognitive processing that are thus slower to build up and slower to disappear than basic emotions: love, guilt, shame, embarrassment, pride, envy and jealousy. He called these "higher cognitive emotions" that are universal like the basic emotions but vary from culture to culture.

Since then, debates on basic emotions and the exact number of emotions have been studied. One widely tool for describing the system of emotions is the "wheel of emotion" which was suggested by Plutchik (1980). Plutchik (1980) first suggested eight primary bipolar emotions: joy versus sadness; anger versus fear; trust versus disgust; and surprise versus anticipation. From there, Plutchik (1980) identified more advanced emotions based on their differences in intensities. Another one of the most extensive proposals is the system of primary and secondary emotions suggested by Parrott (2001), which identified over 100+ emotions and conceptualised them as a tree structured list.

Social network service users can be expected to feel a variety of emotions while using the services. Pareigis, Echeverri and Edvardsson's (2012) definition of service experience also

suggested that customers' emotional responses are directly associated with customer experience. Further, Rodriguez (2013) emphasised that negative emotions can be as important as positive ones towards understanding health issues, relationships or other important human matters.

### ***Why Behavioural Response?***

In the Oxford Dictionary of English (2010), the word "behaviour" is defined as "the way in which an animal or person behaves in response to a particular situation or stimulus" or "the way in which a machine or natural phenomenon works or functions". Particularly in marketing, companies or researchers usually focus on "consumer behaviour", which is defined as "activities people undertake when obtaining, consuming, and disposing of products and services" (Blackwell, Miniard and Engel, 2006).

The study of human behaviour is important not only from the service providers' perspective to understand their customers' attitudes toward the service, but also from the users' perspective to enhance user experience (Jin et al., 2013). According to Engel, Kollat and Blackwell (1968), the consumer decision process consists of five main stages: (1) need recognition, (2) information search, (3) evaluation, (4) purchase and (5) post-purchase. This classic process model evolved along with the market situation. For example, with the advent of the internet, online consumers have become more powerful, demanding and utilitarian than offline consumers due to their improved information gathering ability (Koufaris, 2002). More recently, social media has made consumers even more powerful as their social activities become new information sources (Gatautis and Kazakevičiūtė, 2012), much like word-of-mouth (Owyang, 2012). Consumer behaviour has been studied since the advent of social network services. For example, Li and Owyang (2010) proposed a pyramid framework of consumer engagement process in social network services, and Marsden (2011) suggested a transformed cyclic consumer decision process model. In addition, the previously mentioned user typologies can be part of the stream of studies on consumer behaviour as they are in fact segmentations based on consumer behaviour in social network services.

Studies on consumer behaviour often focus on the theoretical aspects such as the application of classical decision models in social network services, cyclic decision models, user typologies and factors affecting user behaviour. In particular, relatively few have studied the practical aspects of actual user behaviour in social network services. Given that human behaviour is a non-verbal yet the most immediate and tangible response (Skinner, 1953; Stone and La Greca, 1986), better understandings of users would be achievable by observing users' behavioural responses and investigating how these responses are

influenced by their emotions. Patton (2015) also suggested the following ten strengths of human behaviour observation:

- Rich description;
- Contextual sensitivity;
- Being open to what emerges;
- Seeing the unseen;
- Testing old assumptions and generating new insights;
- Opening up new areas of inquiry;
- Delving into sensitive issues;
- Getting beyond selective perceptions of others;
- Getting beyond one's own selective perceptions;
- Experiencing empathy.

The reviews on human emotion and behaviour suggest that it might be beneficial for designers/developers to empathise with users and to develop an in-depth understanding of users' emotional responses (particularly negative ones) and behavioural responses within privacy infringement situations. The main goal of this chapter was therefore to explore how each user group, classified in Chapter 4, differently responds in terms of emotion and behaviour in identical situations of privacy infringement through a user-oriented experiment on Facebook. Doing so would help to identify how users' emotional and behavioural responses are different depending on their perceptions of privacy.

### 5.1 Study Design

#### 5.1.1 Fake Facebook Profiles for the Case Study

For the case study, two fake Facebook profiles were created: a male profile (David Smith) for male participants and a female profile (Linda White) for female participants. The most critical potential limitation of using the fake profiles was that the participants' emotional and behavioural responses might not be fully empathised with the situations. Nevertheless, fake profiles were used because it was not guaranteed that all the privacy infringement situations would occur during the experiment sessions with actual profiles. The participants were thus asked to "role play" (Lewis-Beck, Bryman and Liao, 2004) with the given accounts as if a set of conditions was happening to their own accounts.

In contrast to the profiles used in previous studies (e.g., Bilge et al., 2009; Gao et al., 2010; Boshmaf et al., 2011), more realistic and complex profiles were designed based on the guidelines suggested by Barracuda Labs (2012), a research team of the California-based IT security company Barracuda Networks. This company specifically analysed the

differences between fake and real Facebook profiles with regard to the features such as gender, relationship status, number of friends, education, activities and interests. Despite the ethical difficulties of employing fake profiles in social network services for research, Elovici et al. (2014) suggested the following possible contribution of the operational research using such fake profiles:

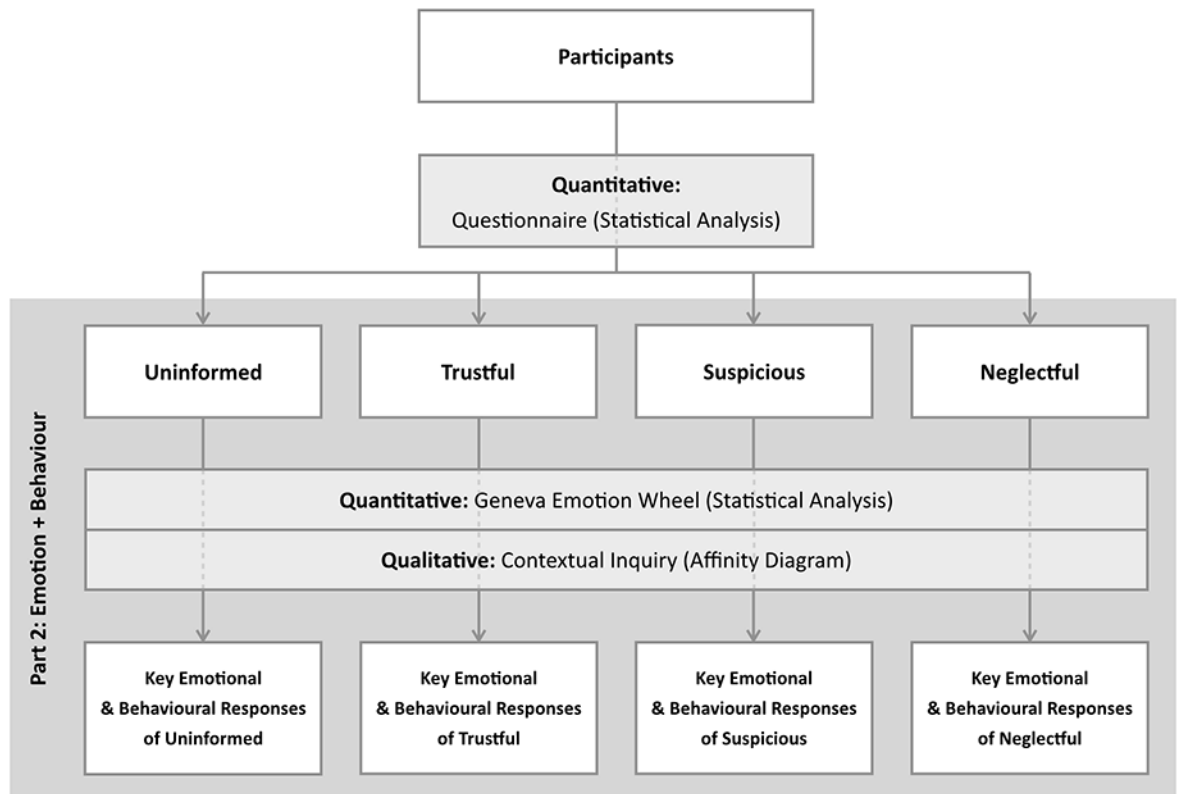
- Designing and improving of social network service products;
- Identifying threats on social network services and their users, including the design of defences;
- Understanding social and economic phenomena.

As Elovici et al. (2014) recommended for ethical reasons, the fake accounts were accessed only for the study and were deactivated and deleted as soon as the data collection process was completed.

### 5.1.2 Research Approach

According to Bryman (2004), a quantitative research approach typically identifies the relationship between theory and research by emphasising the quantification in the collection and analysis of data. As mentioned previously, there have been efforts to establish a comprehensive and systematic theory of human emotions that have resulted in models such as that of the basic emotions (Ekman, 1972; Ekman, 1999), higher cognitive emotions (Griffiths, 1997), wheel of emotions (Plutchik, 1980) and the system of primary and secondary emotions (Parrott, 2001). Since the study intended to investigate how various types of Facebook users feel differently within a specific existing theory of emotion, a quantitative approach was considered appropriate. On the other hand, a qualitative approach is often very useful when describing complex phenomena that require further examination (Creswell, 2003; Johnson and Onwuegbuzie, 2004). Since the exact nature of behavioural responses of Facebook users in various situations of privacy infringement is difficult to predetermine, a qualitative approach was also considered appropriate to investigate the behavioural responses.

The study described in this chapter therefore explored how each user type, classified in Chapter 4, responded differently in terms of emotion and behaviour in identical situations of privacy infringement through both quantitative and qualitative approaches (Figure 5.1). The study also identified each user type's key emotional and behavioural responses by situation.



[Figure 5.1] Research framework: Facebook case study part 2

### 5.1.3 Measures

#### *Emotional Responses*

According to Desmet (2003), emotional responses can be measured either non-verbally or verbally. Non-verbal instruments generally measure the expressive component of emotions such as facial, vocal and postural expressions (e.g., Ekman and Friesen, 1978; Johnstone and Scherer, 2000; Kaiser and Wehrle, 2001) or physiological manifestations such as blood pressure responses, skin responses, pupillary responses, brain waves and heart responses (e.g., Ark, Dryer and Lu, 1999; Picard, 2000). While non-verbal instruments are culture-independent, unobtrusive and less subjective, there are several limitations. In particular, they can assess only a limited set of basic emotions, have low recognition accuracy and cannot assess mixed emotions (Desmet, 2003). Desmet (2003) suggested that the limitations of non-verbal instruments can be overcome by verbal instruments, which assess the subjective feeling component of emotions.

In order to choose an appropriate measurement tool for the study, a comparison of three widely recognised self-assessment techniques was performed — Self-Assessment Manikin (SAM), Product Emotion Measurement Instrument (PrEmo) and Geneva Emotion Wheel (GEW) (Table 5.1). Despite the limitation such as individual differences of awareness and

capability of the self-assessment tools (Mauss and Robinson, 2009), these techniques are particularly useful to measure currently experienced emotions rather than to measure emotions experienced in the past (Robinson and Clore, 2002).

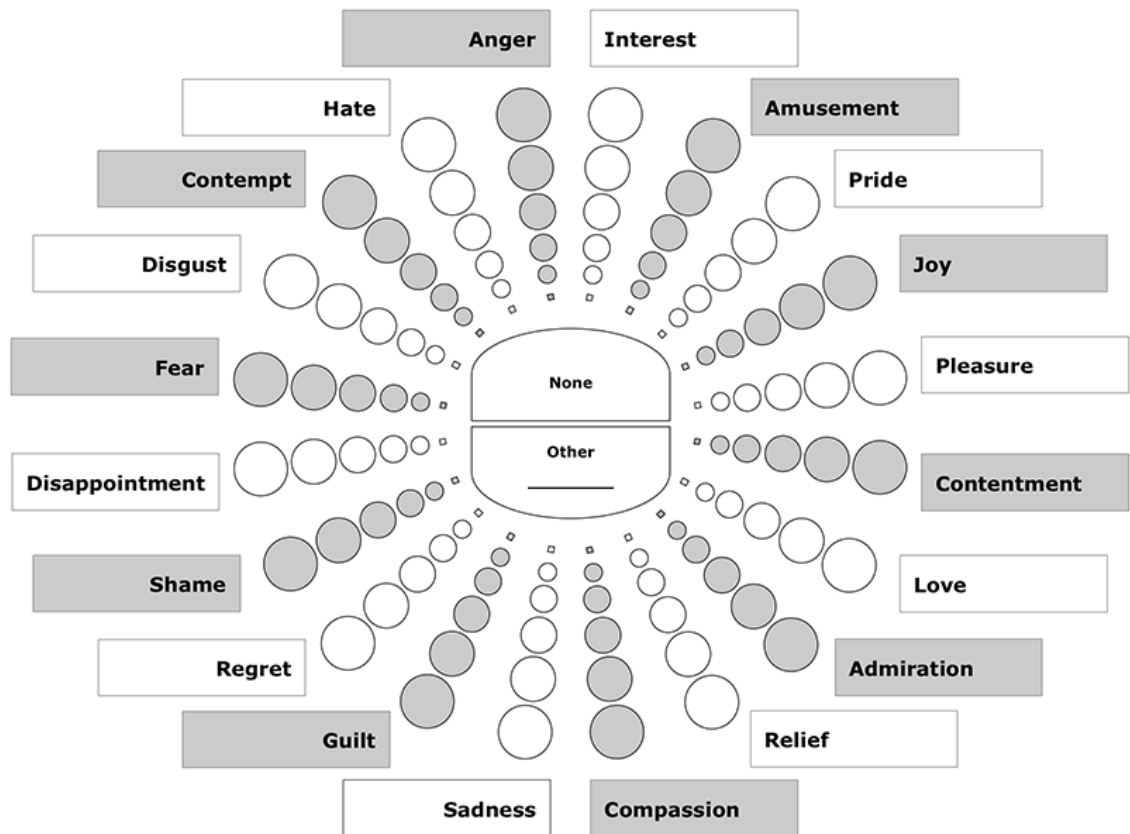
[Table 5.1] Comparison of emotion self-assessment techniques (Source: Lang, 1985; Bradley and Lang, 1994; Desmet, Hekkert and Jacobs, 2000; Desmet, 2003; Scherer, 2005; Caicedo and Van Beuzekom, 2006; Sacharin, Schlegel and Scherer, 2012; Scherer et al., 2013)

	Self-Assessment Manikin (SAM)	Product Emotion Measurement Instrument (PrEmo)	Geneva Emotion Wheel (GEW)
<b>Type</b>	Graphical depiction of the Pleasure, Arousal and Dominance (PAD) emotional state model	12 animated characters with sounds, each representing a specific emotion	20 distinct emotion families arranged in a wheel shape with the axes being defined by two appraisal dimensions – control and pleasantness
<b>Scale</b>	Nine-point scale	Three-point scale	Six-point scale
<b>Advantages</b>	<ol style="list-style-type: none"> <li>1. Pictorial approach: Ideal for cross-cultural environment and assessment of illiterate subjects (e.g., children)</li> <li>2. Very low technical requirements for implementation</li> </ol>	<ol style="list-style-type: none"> <li>1. Pictorial approach: Ideal for cross-cultural environment and assessment of illiterate subjects (e.g., children)</li> <li>2. Use of animations and sounds</li> </ol>	<ol style="list-style-type: none"> <li>1. Easy to be applied to various scenarios</li> <li>2. Very low technical requirements for the collection of data</li> <li>3. Big range of emotions</li> <li>4. Sufficient number of scale for a clear differentiation of intensities</li> <li>5. Arrangement of the scales in a circular response</li> </ol>
<b>Disadvantages</b>	<ol style="list-style-type: none"> <li>1. Unable to measure differentiated emotions</li> <li>2. Unsuitable for measuring emotions elicited by consumer products</li> </ol>	<ol style="list-style-type: none"> <li>1. Limited amount of emotions</li> <li>2. Insufficient number of scale</li> <li>3. Some of animations not completely clear to understand</li> </ol>	Difficult to use in cross-cultural environments

Given the advantages and disadvantages of the three emotion self-assessment techniques, the Geneva Emotion Wheel (Figure 5.2) was chosen as the most appropriate technique for the following reasons:

- Easily applicable to various scenarios;
- Very low technical requirements for the collection of data;
- Wide range of emotions;
- Sufficient number of scales for a clear differentiation of intensities;
- No need to translate the wording of emotions.

The rating scales were six-level Likert scales (from 0 to 5). Although Likert scales are often considered the ordinal level of measurement and treating Likert scales as interval scales has long been controversial (Jamieson, 2004; Norman, 2010), it was presumed that the intervals between values were equal in order to analyse data by parametric test methods, if applicable.



[Figure 5.2] Template of Geneva Emotion Wheel (Source: Scherer et al., 2013)

### ***Behavioural Responses***

Observing and analysing behavioural responses helps to capture not only user experience but also users' thoughts and feelings (Park et al., 2013). Many observation techniques have been introduced to understand user experience and to identify issues so that designers can implement solutions from the early stage of the product or service development life cycle (Park et al., 2013). For example, one widely used technique is the experience sampling method (ESM), in which participants are asked to stop at random times during observation and to make notes of their experience in real time (Csikszentmihalyi and Larson, 1987; Hektner, Schmidt and Csikszentmihalyi, 2007). The log files from this method are very useful to understand how participants experience products or services (Kuniavsky, 2003).

Another often employed method is the day reconstruction method (DRM) proposed by Kahneman et al. (2004), which investigates how participants experience various activities of their lives by asking them to recall memories of the previous day and to construct sequential episodes. According to Karapanos et al. (2009), the DRM can highlight participants' perceived quality of products or services within a single experiential episode such that the data are not biased by preconceptions about the product or service.



Holtzblatt and Beyer (1993) also introduced the contextual inquiry technique, which is defined as “one-on-one interviews conducted in the user’s workspace that focus on observations of ongoing work” (Holtzblatt, Wendell and Wood, 2005), as a part of the contextual design methodology described in Beyer and Holtzblatt (1998) and Holtzblatt, Wendell and Wood (2005). It is a human centred design ethnographic research technique that captures detailed information about how users interact with the product or service in their normal work environment. Ethnography, a longitudinal method for understanding and interpreting a work culture (Spinuzzi, 2000), requires a significant investment of resources and typically lasts six months to a year at minimum (Doheny-Farina and Odell, 1985). However, as contextual inquiry is an “adoption of ethnographic research methods to fit the time and resource constraints of engineering” (Holtzblatt and Beyer, 1993), it is a very intensive technique focusing on specific contexts with a short schedule (e.g., three to six months) involving hour sessions with a small group of participants (e.g., four to twelve participants). Therefore, it is considered ideal for revealing what users actually do, in what manner, and why, as well as latent needs and core values by conducting short, targeted observations and interviews (Spinuzzi, 2000).

Despite a few limitations, such as less representative for generalising and less intrusive compared to ethnography and co-design methods (Spinuzzi, 2000), contextual inquiry is considered an appropriate observation method due to the following advantages suggested by Niola (2013):

- It helps to identify behavioural responses.
- It helps to make and validate design decisions.
- It helps to reach optimal design solutions faster and less expensively.
- It helps to build rapport and understanding of actual users.
- It helps to build effective personas.

### 5.1.4 Data Collection Procedure

After the first part of the data collection described in Chapter 4, the 50 participants were given the preset four privacy infringement scenarios (see Section 5.1.6 for the development of privacy infringement scenarios), displayed full screen on an Apple MacBook Pro 15 inch laptop. The data collection was conducted anywhere available such as offices, atriums and cafes. This non-lab based approach was considered appropriate to allow the participants to naturally perform the tasks in comfortable environments which were similar to those where the service was used. Participants were asked to fill in the Geneva Emotion Wheel immediately after they had confirmed the situation, in order to assess their emotional responses within 15 seconds, which would be within the confines of human short-term memory suggested by Baddeley (1992; 1997). Participants were then asked to

use Facebook with the given fictitious accounts as they normally do with their own accounts (i.e., role play). The second part of the data collection lasted approximately 30 minutes for each participant. Participants were not intervened at the utmost during the observation sessions but were asked about their specific behaviours as occasion required.

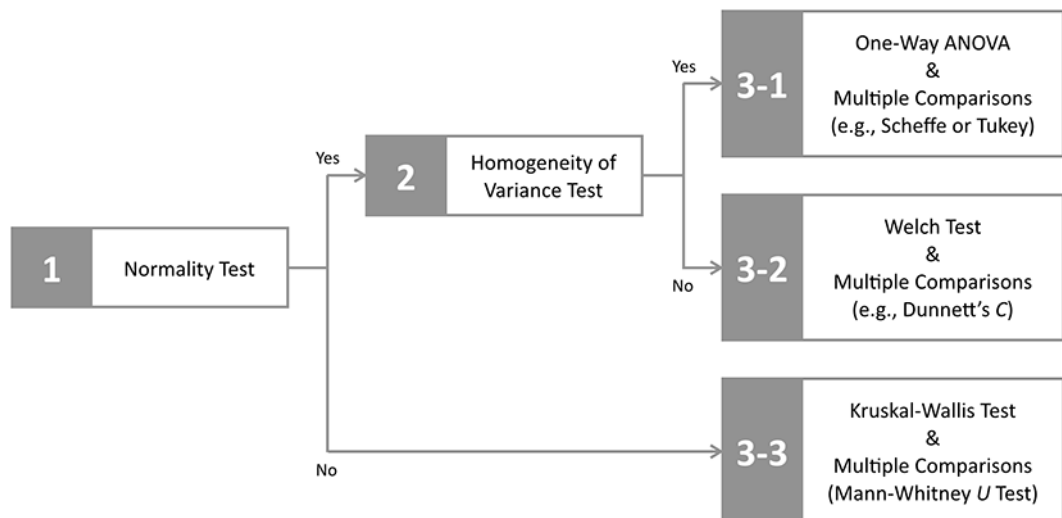
Participants were asked to verbalise whatever they were viewing, thinking, doing and feeling, which is often referred to as a think-aloud technique (Makri, Blandford and Cox, 2011). Although the think-aloud technique has its weaknesses, such as negative effect on the task performance in the case of high task complexity, as well as limited verbalisations due to short term memory and difficulties in producing full accounts of the thinking processes (Van Den Haak, De Jong and Jan Schellens, 2003; Gray and Wardle, 2013), variants of the technique have been widely adopted by several human centred or user centred studies. These variants have been adopted because of the relative demand on the resources of the short term memory, which is essential to the validity and reliability of the data produced (Newell and Simon, 1972; Ericsson and Simon, 1993), and usefulness, particularly in the case of strictly task-oriented usability tests (Van Den Haak, De Jong and Jan Schellens, 2003). Conversations between the participants and the observer along with the think-aloud data were audio-recorded with participants' consent for later analysis. The PC display during the observation sessions was also video-recorded, with participants' consent, to analyse their behavioural responses.

### 5.1.5 Data Analysis

#### 5.1.5.1 Quantitative Analysis

To compare the mean (or median) scores of the emotional responses between the four user types, statistical analysis was performed using IBM SPSS Statistics 22 (Burns and Burns, 2008; Hair et al., 2010; Pallant, 2010; Mooi and Sarstedt, 2011; Green and Salkind, 2012).

In general, one-way analysis of variance (one-way ANOVA), a parametric test, is conducted to evaluate whether the means of a dependent variable differ significantly among groups (Green and Salkind, 2012). Two assumptions underlie one-way ANOVA: (1) normally distributed dataset for each of the population and (2) homogeneity of variance for all population. If the assumption of homogeneity of variance is violated, a Welch test is conducted as an alternative. If the assumption of normality is violated, a Kruskal-Wallis test, a type of non-parametric test, is conducted as another alternative to evaluate whether the medians (instead of means) of each item differ significantly among groups (Green and Salkind, 2012). Figure 5.3 presents the statistical analysis framework applied in the study to evaluate emotion differences between the four user types.



[Figure 5.3] Statistical analysis framework: Comparing means (or medians)

### **Normality Test**

Among 40 different normality test procedures (Dufour et al., 1998), the Shapiro-Wilk test (Shapiro and Wilk, 1965) was chosen. Razali and Wah (2011) claimed in their comparative study of common normality test procedures available in statistical software that the Shapiro-Wilk test was the most powerful for all types of data distribution and sample size.

In no case were all four user types' data normally distributed in a single emotion ( $p < 0.05$ , see Appendix B.3 for the complete results, p. 206). It is not possible to compare the means with the parametric test if at least one case is not normally distributed (Green and Salkind, 2012). In the first situation, for example, only cluster 1 (uninformed) was normally distributed for sadness, meaning that it was not possible to compare each user type's means of sadness with the parametric test.

### **Kruskal-Wallis Test & Multiple Comparisons**

Given the results of the normality test, non-parametric tests — Kruskal-Wallis test and Mann-Whitney  $U$  test — were conducted, and median values were used as representative values instead of mean values for the analysis (Green and Salkind, 2012). If the Kruskal-Wallis test was significant, post hoc multiple comparisons were conducted to examine which pairs of groups differ significantly. At this stage, the familywise error rate (or Type I error), which is the probability of one or more false rejections, occurs across the multiple pairwise tests (Sarkar, Guo and Finner, 2012). In such a case, a technique must be applied manually to correct the familywise error rate.

The Bonferroni correction is considered one of the simplest and most conservative methods to control the familywise error rate (Dunn, 1961; Jaccard, Becker and Wood,

1984; Green and Salkind, 2012). If an experimenter is testing  $n$  dependent or independent hypotheses on a set of data, then one way of correcting the familywise error rate is to test each individual hypothesis at a statistical significance level of  $1/n$  times what it would be if only one hypothesis were tested (Green and Salkind, 2012). For example, if the Kruskal-Wallis test of four groups A, B, C and D is significant, the Mann-Whitney  $U$  test is conducted six times: (1) A-B, (2) A-C, (3) A-D, (4) B-C, (5) B-D and (6) C-D. After six times of the Mann-Whitney  $U$  test, if the desired significance level for the whole family of tests is 0.05, then the Bonferroni correction would be to test each of the individual test at a significance level of 0.0083 ( $= 0.05/6$ ). Therefore, all the significant results of the Mann-Whitney  $U$  tests in this chapter were significant at the 0.0083 level.

### 5.1.5.2 Qualitative Analysis

The qualitative data of behavioural responses were analysed by creating affinity diagrams. The affinity diagram is a hierarchical model of the issues built from interpretation session affinity notes, which structures everything the team has discovered (Beyer and Holtzblatt, 1998; Holtzblatt, Wendell and Wood, 2005). This allows researchers to discover the patterns of key insights across the user population by building a wall-sized hierarchical diagram (Holtzblatt, Wendell and Wood, 2005). As it is a consensus-based approach, the affinity diagram often leads to a strong grouping of results by team members (Otto and Wood, 2001). Four design researchers (including the author) with experience in qualitative analysis, contextual inquiry and affinity diagrams worked as a team to reduce possible subjective bias by a single researcher and to ensure the impartiality. Several interpretation sessions were performed in which the team reviewed the recorded PC display video data and think-aloud audio data, took affinity notes and grouped the notes to create an affinity diagram. Different coloured notes — yellow, blue, pink and green — were used to represent from the lowest to highest levels in the hierarchy as suggested by Holtzblatt, Wendell and Wood (2005). The procedure of creating affinity diagrams was as follows:

- All the yellow affinity notes (over 800 notes including duplicates) of participants' behaviour taken during the observation and interpretation sessions were collected and listed.
- The collected yellow notes were then classified into blue labels that represented duplicated or similar behavioural responses.
- The blue labels were classified further into pink labels that represented the behavioural responses with the same purposes.
- The pink notes were classified into three green labels: perception, immediate action and precaution. These labels represent the key phases of dealing with the privacy infringement situations by the participants.

By classifying into situations and merging with the identified user types, key behavioural responses of each user type were defined by creating the final affinity diagrams for each situation.

### 5.1.6 Pilot Study: Privacy Infringement Scenarios

The study could not deal with every possible privacy infringement situation in Facebook. Therefore, a pilot study was conducted in order to narrow down to an achievable number of situations. Table 5.2 presents 12 privacy infringement situations that can be categorised into four privacy concerns suggested by Boyd and Ellison (2007), Debatin et al. (2009) and Power and Kirwan (2015).

[Table 5.2] Privacy infringement situations for the pilot study

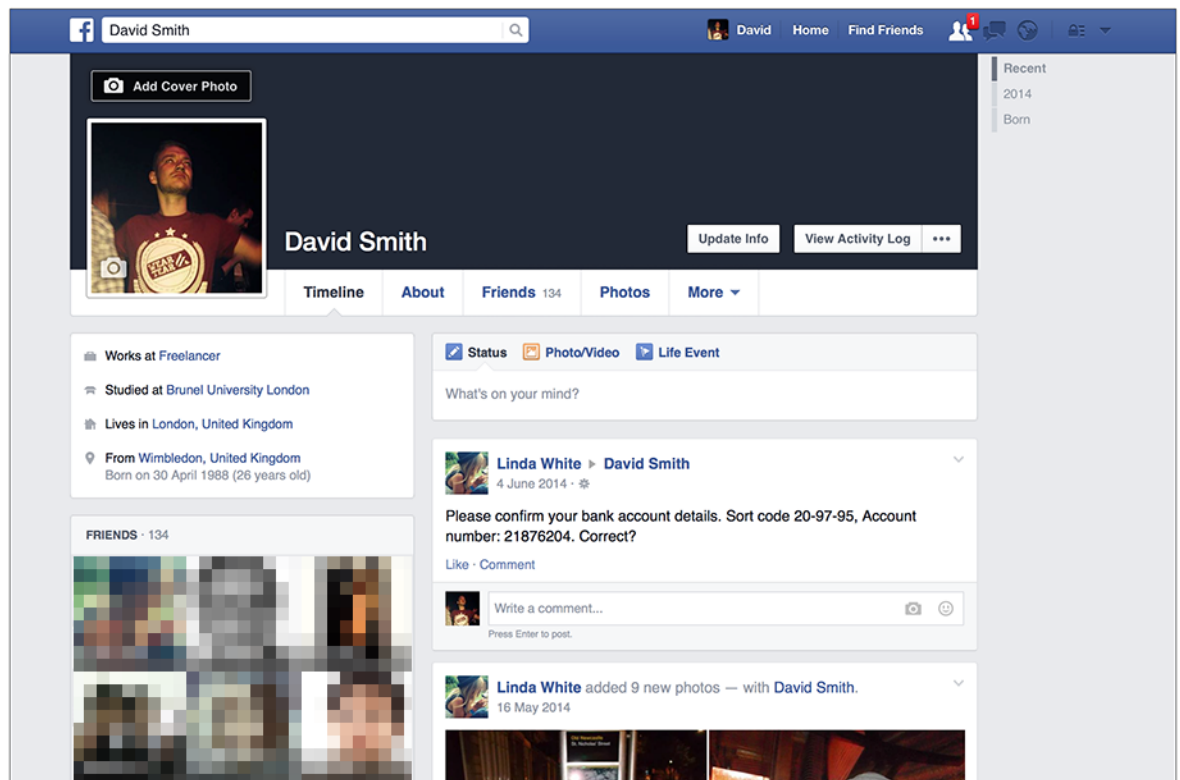
Privacy Concern	Situation	Source
Inadvertent disclosure of personal information	Date of birth	Gross and Acquisti, 2005
	Bank account number	Gross and Acquisti, 2005
	Personal identification number (PIN)	Gross and Acquisti, 2005
Damaged reputation due to rumours/gossip	Negative/humiliating posts on the timeline	Das and Sahoo, 2011
	Rumours/gossip about my relationship status	Boyd, 2008a; Debatin et al., 2009
	Embarrassing photos	Barnes, 2006; Ahern et al., 2007; Lipton, 2010
Unwanted contact and harassment/stalking	Spam messages from strangers	Gao et al., 2012
	Direct contacts from strangers due to personal information disclosure	Debatin et al., 2009
	Employer's account monitoring	Barnes, 2006; Economist, 2008; Mooney, 2009
Surveillance-like structure	Friend requests from others through recommender system	Gürses, Rizk and Günther, 2008; Xie, 2010
	Notification of profile view by others	Higgins, Ricketts and Vegh, 2008; Das and Sahoo, 2011
	Activities available to friends-of-friends	Gürses, Rizk and Günther, 2008

The hypothesis of the pilot study was that the participants' emotional responses would not statistically differ among three situations in one privacy concern. For example, in the first privacy concern in Table 5.2, if participants' emotional responses did not differ among the situations of date of birth disclosure, bank account number disclosure and personal identification number disclosure, it may be possible to choose any single situation in the "inadvertent disclosure of personal information" concern to develop a scenario for the experiment.

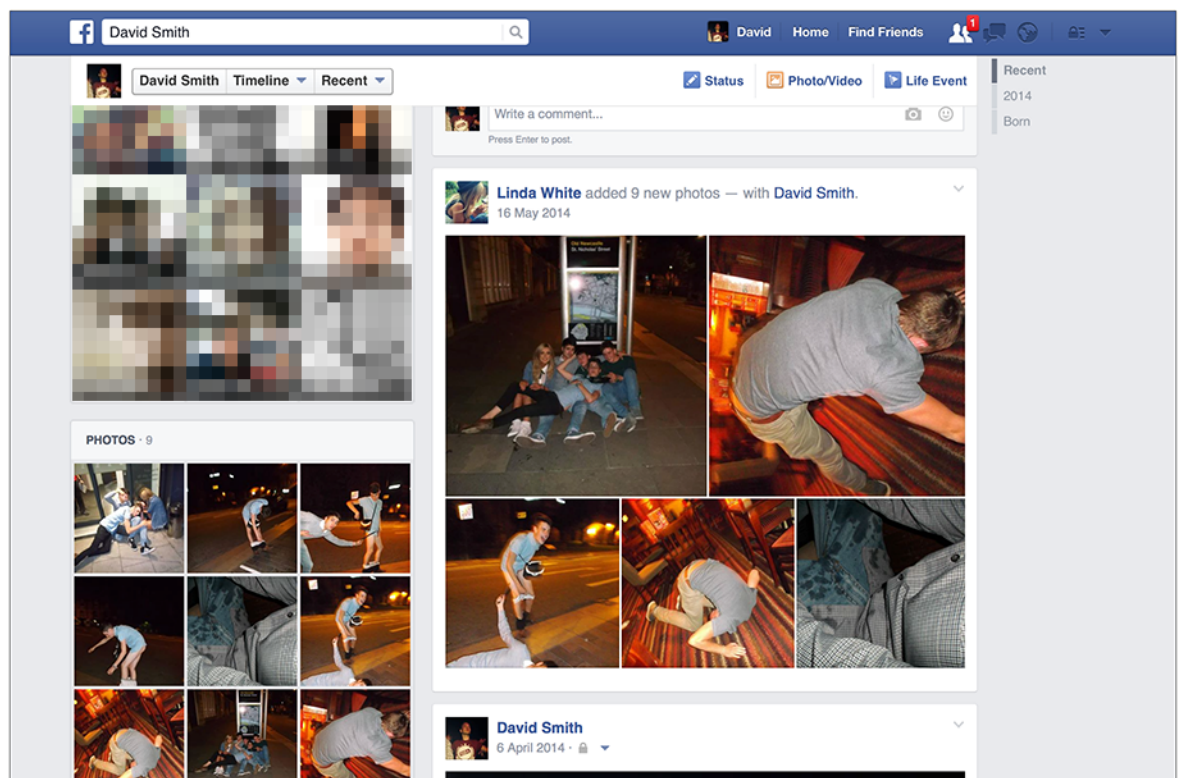
Ten participants were asked to self-assess their emotions using the Geneva Emotion Wheel by assuming that the 12 situations occur within their Facebook accounts. The situations were presented randomly to prevent the participants from being aware of the categories, and the framework shown in Figure 5.3 was employed for the statistical analysis. The collected data were found to be not normally distributed ( $p < 0.05$ , see Appendix B.2 for the complete results, p. 203). A Kruskal-Wallis test revealed that the differences among participants' emotional responses in all three situations in each concern were not statistically significant ( $p \geq 0.05$ , see Appendix B.2 for the complete results, p. 205). Therefore, one representative situation in each concern was developed into a scenario for the main study — four scenarios in total. The following four scenarios for each privacy concern were developed with verisimilar stories on Facebook:

- **Situation 1 (Inadvertent disclosure of personal information):** On my timeline, one of my friends posted my bank account details. I want to determine who read the post and how to deal with this situation (Figure 5.4).
- **Situation 2 (Damaged reputation due to rumours/gossip):** One of my friends uploaded some photos and tagged me in them. I do not want to show the photos to anyone because they were taken when I was intoxicated. I want to find out who has viewed the photos and how to deal with this situation (Figure 5.5).
- **Situation 3 (Unwanted contact and harassment/stalking):** A stranger has been continuously sending me spam messages based on my personal information. I want to determine this person's identity and learn how he/she knows what I have bought or where I have recently visited (Figure 5.6).
- **Situation 4 (Surveillance-like structure):** A stranger has sent me a friend request. He/she may be a friend of a friend or someone who was recommended to me. I want to find out who it is and how he/she could reach me (Figure 5.7).

## 5. Facebook Case Study Part 2: SNS Users' Emotional and Behavioural Responses

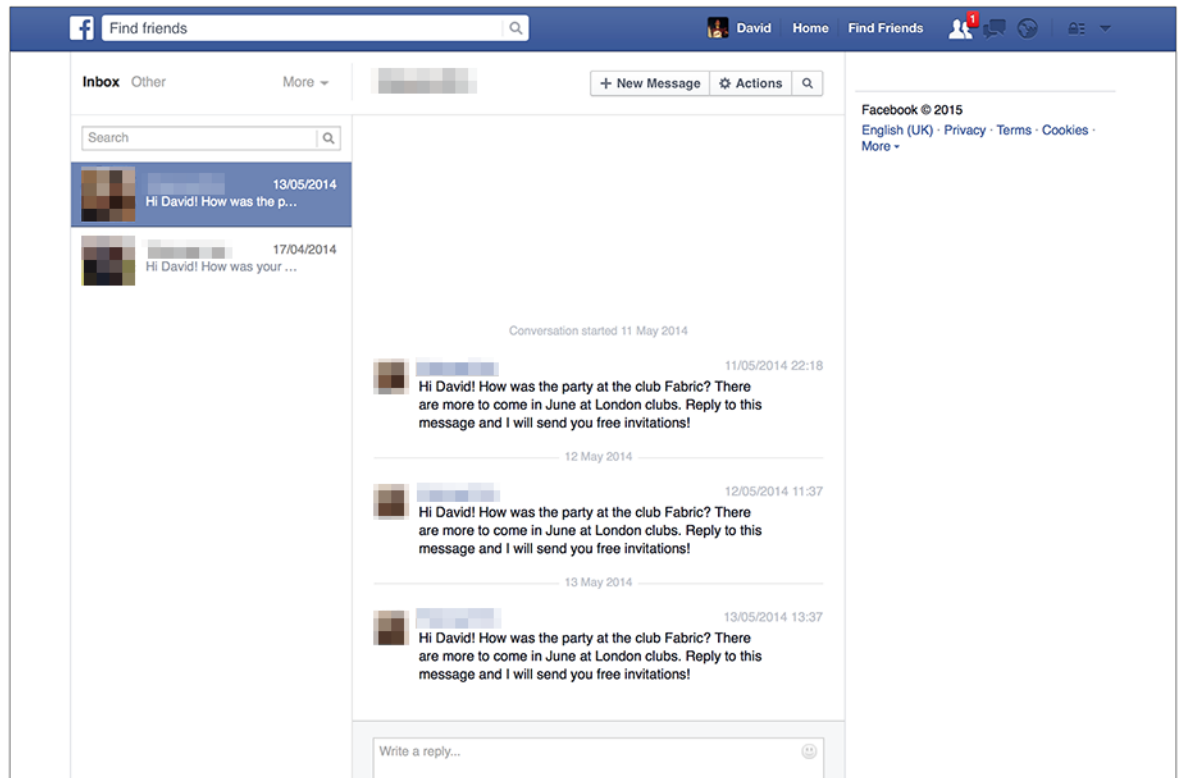


[Figure 5.4] Screen shot of situation 1: Inadvertent disclosure of personal information

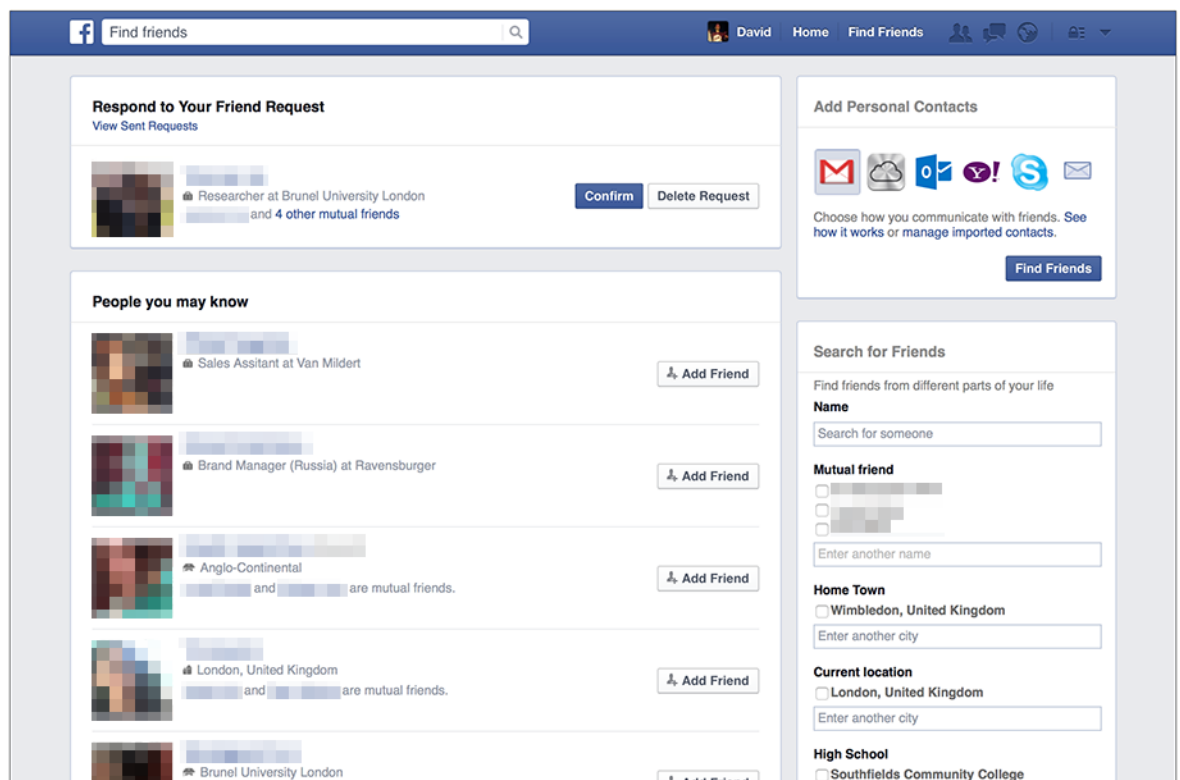


[Figure 5.5] Screen shot of situation 2: Damaged reputation due to rumours/gossip

## 5. Facebook Case Study Part 2: SNS Users' Emotional and Behavioural Responses



[Figure 5.6] Screen shot of situation 3: Unwanted contact and harassment/stalking



[Figure 5.7] Screen shot of situation 4: Surveillance-like structure



## 5.2 Results

### 5.2.1 Key Emotional Responses: Statistical Analysis

The number of emotion measures was 20 in each situation. It was thus necessary to screen out relatively insignificant data for the practicality of analysis. The threshold discretionally defined was the half-value; thus, the emotional responses only with the medians from three to five were used for the data analysis and were labelled “emerged” emotional responses. However, these emerged emotional responses would not be necessarily meaningful. Kruskal-Wallis test and multiple comparisons were thus used to identify “key” emotional responses, which refers to particular emerged emotional responses that differ significantly from non-emerged emotional responses as a result of the statistical analysis.

#### ***Situation 1: Inadvertent Disclosure of Personal Information***

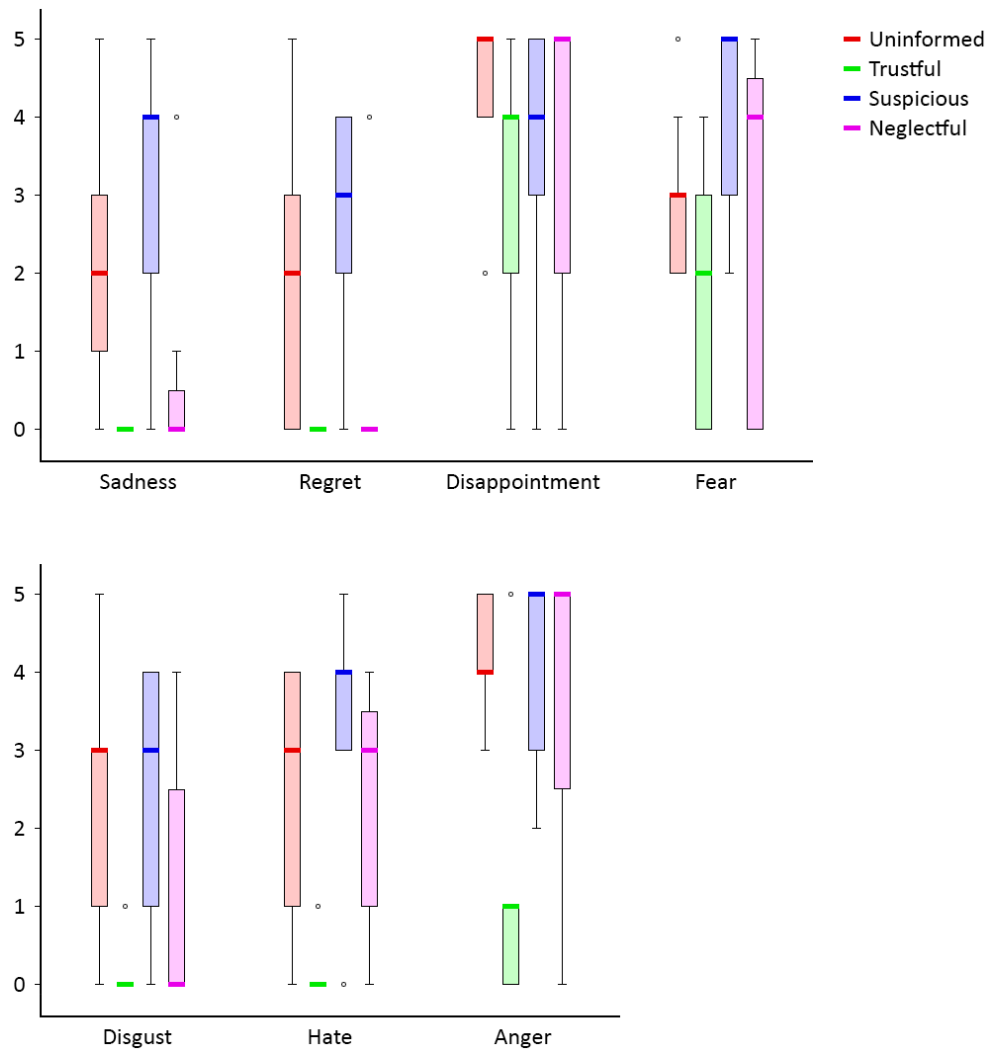
In the first situation, there were eight emerged emotional responses across all user types: sadness, regret, disappointment, fear, disgust, contempt, hate and anger. The result of Kruskal-Wallis test revealed that six out of the eight emotional responses differed significantly ( $p < 0.05$ ) among clusters. Disappointment emerged from all user types, but was not involved in the six emotions. The post hoc multiple comparisons with the six emotional responses were conducted using Mann-Whitney  $U$  test to determine which pairs of cluster exhibited differences.

[Table 5.3] Situation 1: Results of Kruskal-Wallis test and Mann-Whitney  $U$  tests (*Note.* Cluster 1: Uninformed, Cluster 2: Trustful, Cluster 3: Suspicious, Cluster 4: Neglectful)

Dependent Variable	Cluster	Median	Kruskal-Wallis	Mann-Whitney $U$	Dependent Variable	Cluster	Median	Kruskal-Wallis	Mann-Whitney $U$
			Chi-Square / Sig.	Post Hoc				Chi-Square / Sig.	Post Hoc
Sadness	1	2	23.001 / 0.000	3 ≠ 1 3 > 2 3 > 4	Disgust	1	3	16.509 / 0.001	1 > 2 1 ≠ 4 3 > 2 3 ≠ 4
	2	0				2	0		
	3	4				3	3		
	4	0				4	0		
Regret	1	2	24.564 / 0.000	3 ≠ 1 3 > 2 3 > 4	Hate	1	3	19.825 / 0.000	1 > 2 3 > 2 4 > 2
	2	0				2	0		
	3	3				3	4		
	4	0				4	3		
Fear	1	3	14.285 / 0.003	1 ≠ 2 3 > 2 4 ≠ 2	Anger	1	4	13.874 / 0.003	1 > 2 3 > 2 4 ≠ 2
	2	2				2	1		
	3	5				3	5		
	4	4				4	5		

Table 5.3 presents the results of the Kruskal-Wallis test and multiple comparisons with the six emotional responses in the first situation, and Figure 5.8 presents boxplots of the

distributions for each emotion (including disappointment), clustered according to the four user types (see Appendix B.3 for the complete results, p. 208).



[Figure 5.8] Situation 1: Boxplots of distributions for each emotion clustered according to user types

Given the post hoc multiple comparisons and boxplots, four emotional responses — disappointment, fear, hate and anger — were identified as key emotional responses, and Table 5.4 presents the key emotional responses of each user type in the first situation.

[Table 5.4] Situation 1: Key emotional responses of each user type

	Emotion	Uninformed	Trustful	Suspicious	Neglectful
<b>Inadvertent Disclosure of Personal Information</b>	Disappointment	✓	✓	✓	✓
	Fear			✓	
	Hate	✓		✓	✓
	Anger	✓		✓	

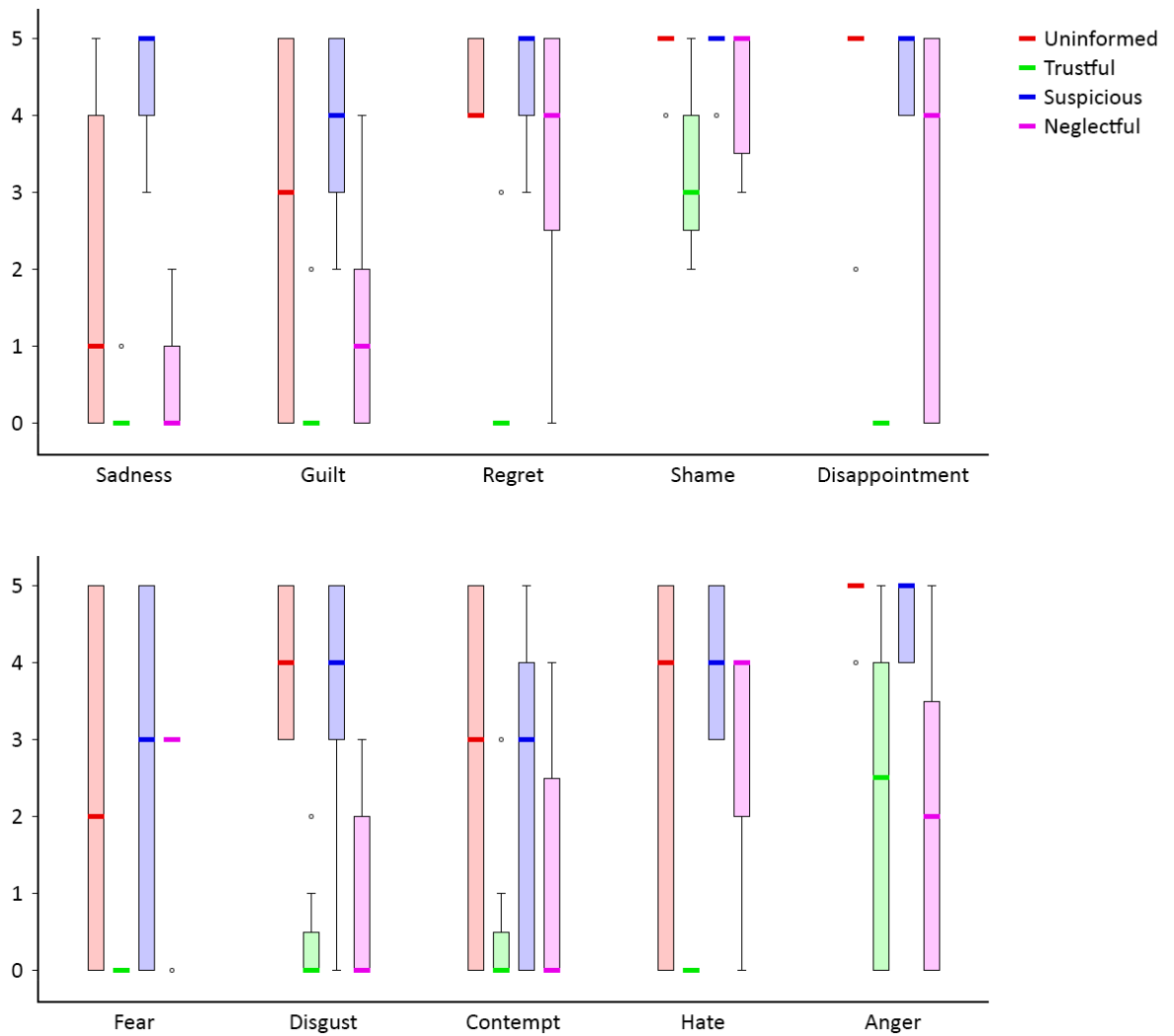
**Situation 2: Damaged Reputation Due to Rumours/Gossip**

In the second situation, there were ten emerged emotional responses across all user types: sadness, guilt, regret, shame, disappointment, fear, disgust, contempt, hate and anger. The result of Kruskal-Wallis test revealed that all the ten emotional responses differed significantly ( $p < 0.05$ ) among clusters. Shame emerged from all user types. The post hoc multiple comparisons with the nine emotional responses (excluding shame) were conducted using Mann-Whitney  $U$  test to determine which pairs of cluster exhibited differences. Table 5.5 presents the results of the Kruskal-Wallis test and multiple comparisons with the nine emotional responses in the second situation, and Figure 5.9 presents boxplots of the distributions for each emotion (including shame), clustered according to the four user types (see Appendix B.3 for the complete results, p. 210).

[Table 5.5] Situation 2: Results of Kruskal-Wallis test and Mann-Whitney  $U$  tests (*Note.* Cluster 1: Uninformed, Cluster 2: Trustful, Cluster 3: Suspicious, Cluster 4: Neglectful)

Dependent Variable	Cluster	Median	Kruskal-Wallis	Mann-Whitney $U$	Dependent Variable	Cluster	Median	Kruskal-Wallis	Mann-Whitney $U$
			Chi-Square / Sig.	Post Hoc				Chi-Square / Sig.	Post Hoc
Sadness	1	1	31.919 / 0.000	3 > 1 3 > 2 3 > 4	Disgust	1	4	34.013 / 0.000	1 > 2 1 > 4 3 > 2 3 > 4
	2	0				2	0		
	3	5				3	4		
	4	0				4	0		
Guilt	1	3	24.309 / 0.000	1 > 2 1 ≠ 4 3 > 2 3 > 4	Contempt	1	3	9.230 / 0.026	1 > 2 1 ≠ 4 3 ≠ 2 3 ≠ 4
	2	0				2	0		
	3	4				3	3		
	4	1				4	0		
Regret	1	4	29.196 / 0.000	1 > 2 3 > 2 4 > 2	Hate	1	4	23.923 / 0.000	1 > 2 3 > 2 4 > 2
	2	0				2	0		
	3	5				3	4		
	4	4				4	4		
Disappointment	1	5	30.514 / 0.000	1 > 2 3 > 2 4 > 2	Anger	1	5	26.049 / 0.000	1 > 2 1 > 4 3 > 2 3 > 4
	2	0				2	2.5		
	3	5				3	5		
	4	4				4	2		
Fear	1	2	16.451 / 0.001	3 ≠ 1 3 > 2 4 ≠ 1 4 > 2					
	2	0							
	3	3							
	4	3							

## 5. Facebook Case Study Part 2: SNS Users' Emotional and Behavioural Responses



[Figure 5.9] Situation 2: Boxplots of distributions for each emotion clustered according to user types

Given the post hoc multiple comparisons and boxplots, eight emotional responses — sadness, guilt, regret, shame, disappointment, disgust, hate and anger — were identified as key emotional responses, and Table 5.6 presents the key emotional responses of each user type in the second situation.

[Table 5.6] Situation 2: Key emotional responses of each user type

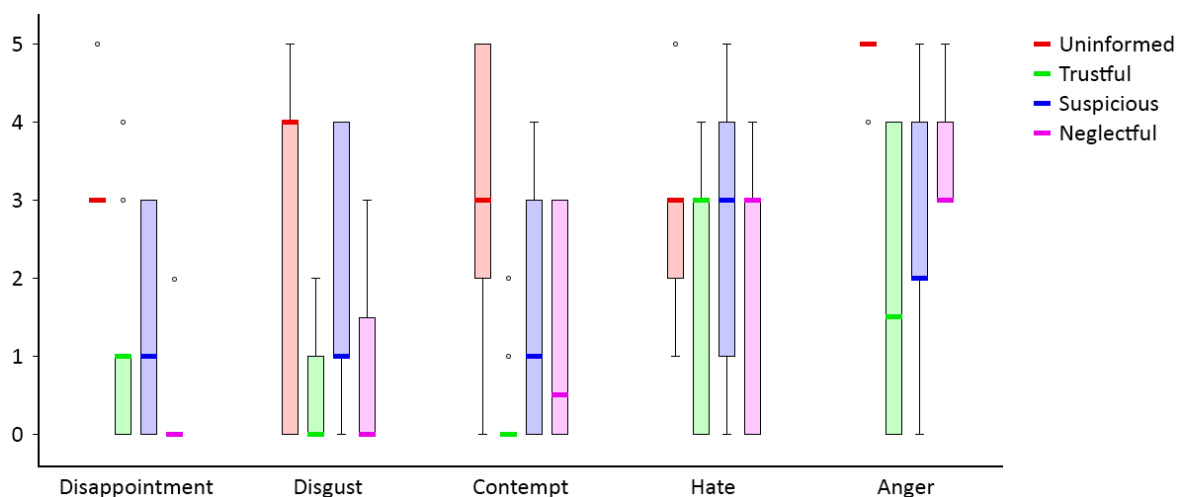
	Emotion	Uninformed	Trustful	Suspicious	Neglectful
<b>Damaged Reputation Due to Rumours/Gossip</b>	Sadness			✓	
	Guilt			✓	
	Regret	✓		✓	✓
	Shame	✓	✓	✓	✓
	Disappointment	✓		✓	✓
	Disgust	✓		✓	
	Hate	✓		✓	✓
	Anger	✓		✓	

**Situation 3: Unwanted Contact and Harassment/Stalking**

In the third situation, there were five emerged emotional responses across all user types: disappointment, disgust, contempt, hate and anger. The result of Kruskal-Wallis test revealed that four out of the five emotional responses differed significantly ( $p < 0.05$ ) among clusters. Hate emerged from all user types, but was not involved in the four emotions. The post hoc multiple comparisons with the four emotional responses were conducted using Mann-Whitney  $U$  test to determine which pairs of cluster exhibited differences. Table 5.7 presents the results of the Kruskal-Wallis test and multiple comparisons with the four emotional responses in the third situation, and Figure 5.10 presents boxplots of the distributions for each emotion (including hate), clustered according to the four user types (see Appendix B.3 for the complete results, p. 212).

[Table 5.7] Situation 3: Results of Kruskal-Wallis test and Mann-Whitney  $U$  tests (Note. Cluster 1: Uninformed, Cluster 2: Trustful, Cluster 3: Suspicious, Cluster 4: Neglectful)

Dependent Variable	Cluster	Median	Kruskal-Wallis	Mann-Whitney $U$	Dependent Variable	Cluster	Median	Kruskal-Wallis	Mann-Whitney $U$
			Chi-Square / Sig.	Post Hoc				Chi-Square / Sig.	Post Hoc
Disappointment	1	3	25.693 / 0.000	1 > 2 1 > 3 1 > 4	Contempt	1	3	15.380 / 0.002	1 > 2 1 > 3 1 > 4
	2	1				2	0		
	3	1				3	1		
	4	0				4	0.5		
Disgust	1	4	12.293 / 0.006	1 > 2 1 > 3 1 > 4	Anger	1	5	23.770 / 0.000	1 > 2 1 > 3 4 > 2 4 > 3
	2	0				2	1.5		
	3	1				3	2		
	4	0				4	3		



[Figure 5.10] Situation 3: Boxplots of distributions for each emotion clustered according to user types

Given the post hoc multiple comparisons and boxplots, three emotional responses — disappointment, hate and anger — were identified as key emotional responses, and Table 5.8 presents the key emotional responses of each user type in the third situation.

[Table 5.8] Situation 3: Key emotional responses of each user type

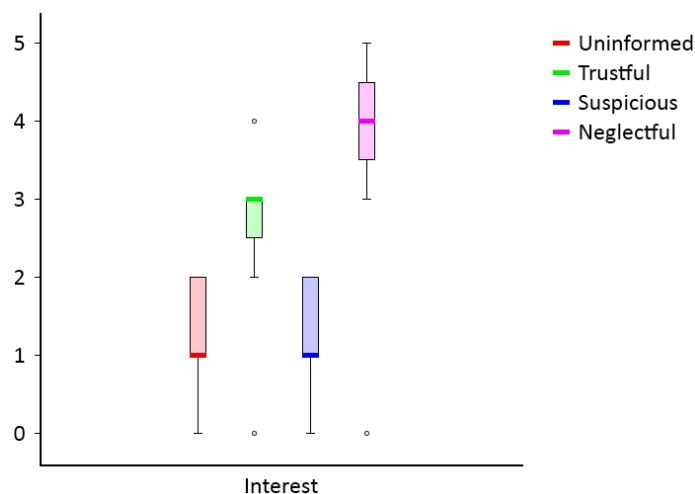
	Emotion	Uninformed	Trustful	Suspicious	Neglectful
<b>Unwanted Contact and Harassment/Stalking</b>	Disappointment	✓			
	Hate	✓	✓	✓	✓
	Anger	✓			

**Situation 4: Surveillance-like Structure**

In the fourth situation, there was only one emerged emotional response: interest. The result of Kruskal-Wallis test revealed that the emerged emotional response differed significantly ( $p < 0.05$ ) among clusters. The post hoc multiple comparisons with the emotional response interest were conducted using Mann-Whitney *U* test to determine which pairs of cluster exhibited differences. Table 5.9 presents the results of the Kruskal-Wallis test and multiple comparisons with the emotional response interest in the fourth situation, and Figure 5.11 presents boxplots of the distributions for the emotion interest clustered according to the four user types (see Appendix B.3 for the complete results, p. 214).

[Table 5.9] Situation 4: Results of Kruskal-Wallis test and Mann-Whitney *U* tests (Note. Cluster 1: Uninformed, Cluster 2: Trustful, Cluster 3: Suspicious, Cluster 4: Neglectful)

Dependent Variable	Cluster	Median	Kruskal-Wallis	Mann-Whitney <i>U</i>
			Chi-Square / Sig.	Post Hoc
Interest	1	1	19.510 / 0.000	2 > 1
	2	3		2 > 3
	3	1		4 > 1
	4	4		4 > 3



[Figure 5.11] Situation 4: Boxplots of distributions for each emotion clustered according to user types

Given the post hoc multiple comparisons and boxplots, the emotional response interest was identified as the key emotional response, and Table 5.10 presents the key emotional response of each user type in the fourth situation.

[Table 5.10] Situation 4: Key emotional response of each user type

	Emotion	Uninformed	Trustful	Suspicious	Neglectful
Surveillance-like Structure	Interest		✓		✓

### 5.2.2 Key Behavioural Responses: Affinity Diagrams

Numerous behavioural responses were found in each situation. Thus, it was necessary to screen out relatively insignificant data for the practicality of analysis. Figures 5.12 to 5.15 present the affinity diagrams by situation. The threshold discretionally defined was the half-value; thus, the behavioural responses that emerged from the majority (more than half) of each user type were interpreted as meaningful results (white boxes in Figures 5.12 to 5.15, the numbers in the boxes indicate how many participants showed the corresponding responses). The remainder were screened out (grey boxes in Figures 5.12 to 5.15). If the majority of at least one user type showed a specific behavioural response, it was labelled a “key behavioural response” in the corresponding situations.

			Uninformed (N = 13)	Trustful (N = 12)	Suspicious (N = 13)	Neglectful (N = 12)
<b>Perception</b>	Checking who have read the posts	Check posted time	3	11	12	2
		Check the number of like/comment	3	9	11	1
	Checking disclosure condition of the posts	Check who can see the post	4	9	9	5
		Check if it appears anywhere else	1	1	1	0
	Checking account history	Check activity log	0	2	0	0
<b>Immediate Action</b>	Dealing with posts	Delete post	10	11	11	12
		Hide post	3	0	2	0
		Leave comment	0	1	0	0
	Contacting the other party	Send message in Facebook	3	9	3	8
		Contact directly using phone/email	8	4	10	5
	Checking damage	Contact bank	3	2	9	4
<b>Precaution</b>	Taking precaution against further threats	Privacy settings (Who can see?)	2	9	10	3
		Timeline settings (Who can post?)	2	9	10	3

[Figure 5.12] Situation 1: Key behavioural responses of each user type

## 5. Facebook Case Study Part 2: SNS Users' Emotional and Behavioural Responses

			Uninformed (N = 13)	Trustful (N = 12)	Suspicious (N = 13)	Neglectful (N = 12)
Perception	Checking who have viewed photos	Check uploaded time	3	<b>11</b>	<b>12</b>	2
		Check the number of like/comment	3	<b>9</b>	<b>11</b>	1
	Checking disclosure condition of photos	Check who can see the photos	4	<b>9</b>	<b>9</b>	5
Immediate Action	Dealing with photos/tags	Remove tags from all photos	<b>8</b>	1	<b>10</b>	3
		Remove tags from selected photos	3	<b>8</b>	2	<b>8</b>
		Leave tags but hide from timeline	1	0	1	1
		Leave tags and photos	1	3	0	1
		Leave comments	0	2	0	1
	Contacting the other party	Send message in Facebook	4	<b>8</b>	4	<b>9</b>
		Contact directly using phone/email	<b>8</b>	1	<b>9</b>	2
Reporting as spam	Report to Facebook	2	0	3	0	
Precaution	Taking precaution against further threats	Privacy settings (Who can see?)	2	<b>9</b>	<b>10</b>	3
		Timeline settings (Who can post?)	2	<b>9</b>	<b>10</b>	3

[Figure 5.13] Situation 2: Key behavioural responses of each user type

			Uninformed (N = 13)	Trustful (N = 12)	Suspicious (N = 13)	Neglectful (N = 12)
Perception	Looking for any possible connection with the other party	Check mutual friends	1	1	0	2
		Check the other party's profile	<b>7</b>	2	0	5
	Looking over the other party's activities	Check the other party's activities	1	2	0	1
Immediate Action	Dealing with messages	Ignore message	1	<b>10</b>	<b>8</b>	<b>8</b>
		Reply to message	3	0	0	2
		Delete message	<b>9</b>	2	5	2
	Dealing with the other party	Block user immediately	<b>9</b>	3	4	2
		Block user if repeated	2	4	<b>9</b>	<b>8</b>
	Reporting as spam	Report to Facebook immediately	<b>7</b>	0	1	3
		Report to Facebook if repeated	3	3	0	2
Precaution	Taking precaution against further threats	Privacy settings (Who can contact?)	2	<b>9</b>	<b>10</b>	3
	Leaving Facebook	Stop using Facebook	1	0	0	0

[Figure 5.14] Situation 3: Key behavioural responses of each user type



## 5. Facebook Case Study Part 2: SNS Users' Emotional and Behavioural Responses

			Uninformed (N = 13)	Trustful (N = 12)	Suspicious (N = 13)	Neglectful (N = 12)
Perception	Looking for any possible connection with the other party	Check mutual friends	9	12	12	12
		Check the other party's profile	3	8	3	9
	Looking over the other party's activities	Check the other party's activities	2	7	1	8
		Check the other party's photos	2	7	1	7
Immediate Action	Dealing with requests	Ignore request	3	9	8	8
		Hide request	2	0	2	2
		Decline request	7	2	3	1
		Accept request	1	1	0	1
	Dealing with the other party	Block user	3	1	2	0
Precaution	Taking precaution against further threats	Privacy settings (Who can contact?)	2	9	10	3

[Figure 5.15] Situation 4: Key behavioural responses of each user type

### 5.3 Discussion

The main goal of this chapter was to explore how each user group, classified in Chapter 4, differently responded in terms of emotion and behaviour in identical situations of privacy infringement through a user-oriented experiment on Facebook. The following sections describe how these emotional and behavioural responses were different by situation.

#### ***Situation 1: Inadvertent Disclosure of Personal Information***

In the first scenario for the experiment, one of the participant's friends has disclosed the participant's bank account details publicly. In fact, the bank account details in the UK are not confidential, otherwise it would not be printed on debit cards or bank statements (Stevens, 2008). Nevertheless, Stevens (2008) warned that it is possible to remove funds from an account with the bank account information alone. Das and Sahoo (2011) also advised users not to post very personal information on their profiles in order to remain safe on social network services.

Participants' key emotional responses in situation 1 were negative — disappointment, fear, hate and anger. Notable in the first situation was that disappointment emerged from all user types. Disappointment is defined in psychology as “the experience of sadness involving unfulfilled hope” which creates a positive expectation (Lamia, 2012). In this sense, recalling the definition of trust in an interpersonal context mentioned in Section 4.3.1, disappointment can directly violate one's expectation of the other party. This could mean

that disappointment is an emotion closely related to trust, one of the most essential prerequisites for the openness in an interpersonal context (Malhotra, Kim and Agarwal, 2004; Whitty and Joinson, 2008).

A notable behavioural response in the first situation was that the majority of “trustful” and “suspicious” participants showed a tendency to grasp the situation very readily compared to the other two user types. As expected, the majority of all user types showed a tendency to delete a post immediately because the disclosed financial information was considered highly sensitive and risky. This behavioural response is consistent with the advice suggested by Stevens (2008) and Das and Sahoo (2011). Some participants tried to contact the other party. The majority of “suspicious” and “uninformed” participants stressed that they would directly make a phone call, send SMS or email to prevent further risks, whereas the other two user types primarily used a message feature provided by the service. It was also noteworthy that the majority of “suspicious” participants showed a tendency to check the internet banking or directly contact the bank. Finally, following the immediate actions, the majority of “trustful” and “suspicious” participants tended to take precautions against further threats. They checked the privacy settings to determine who could see the post and the timeline settings to control who could post on their timelines. The behavioural responses of precaution shown by “trustful” and “suspicious” participants were consistent with Das and Sahoo’s (2011) guideline: “Change the profile privacy now”.

### ***Situation 2: Damaged Reputation Due to Rumours/Gossip***

In the second scenario, participant reputations might be damaged due to the online publication of humiliating photos. Participants’ key emotional responses in situation 2 were eight negative ones: sadness, guilt, regret, shame, disappointment, disgust, hate and anger. Notable in the second situation was that shame emerged from all user types. According to Lamia (2012), shame is an emotion “experienced as extreme self-consciousness that makes you want to hide”.

Although it is upsetting that the emotion shame is elicited by some rumours, gossip or humiliating photos, users need to be cautious of posting photos on social network services for different reasons. For example, because a large number of users tend to post very similar or identical photos of themselves on social network services, Gross and Acquisti (2005) warned that the users need to be aware of the identifiability of their pseudonym profiles, which is referred to as “face re-identification”. Das and Sahoo (2011) also advised that the background of posted photos can be a clue to users’ geographical location. In addition, Whitty and Joinson (2008) warned of the possibility of unintentional disclosure of photos to professional connections such as potential employers or universities (e.g.,

Garone, 2013). In an actual case, a high school English teacher was fired because of some photos posted on her profile (Sullivan, 2011).

One notable behavioural response in the second situation was that the majority of “trustful” and “suspicious” participants showed a tendency to grasp the situation very readily compared to the other two user types. The majority of participants in all user types removed tags from photos. This behavioural response is consistent with the advice suggested by Gross and Acquisti (2005), Whitty and Joinson (2008) and Das and Sahoo (2011). However, some different behavioural responses were found. The majority of “suspicious” and “uninformed” participants removed tags from all photos, whereas the other two user types removed tags from selected photos. Some different behavioural responses were also found when the participants tried to contact the other party to remove the photos from the service. The majority of “suspicious” and “uninformed” participants said that they would directly make a phone call, whereas the other two user types mostly used a message feature provided by the service. Participants’ efforts not only to remove their tags from the photos, but also to remove the photos from the service are also consistent with the advice suggested by Gross and Acquisti (2005), Whitty and Joinson (2008) and Das and Sahoo (2011). Finally, following the immediate actions, the majority of “trustful” and “suspicious” participants took precautions against further threats. They checked the privacy settings to determine who could see the photos and the timeline settings to control who could upload and tag photos on their timelines in the future. Similar to the first situation, the behavioural responses of precaution shown by “trustful” and “suspicious” participants were consistent with Das and Sahoo’s (2011) guideline: “Change the profile privacy now”.

### ***Situation 3: Unwanted Contact and Harassment/Stalking***

In the third scenario, spam messages were received regularly from a stranger. Those spam messages were not merely advertisements; rather, the content appeared to be based on the user’s previous activities.

Spam messages have been an serious issue since people began to use email, so the spam issue has been extensively studied for years (Gao et al., 2012). After social network services proliferated, popular services with a large number of active users became the target of phishing attacks (Kulkarni, 2009; Touchette, 2009). Also, there are large-scale spam campaigns on Facebook and Twitter (Gao et al., 2010; Grier et al., 2010). Moreover, the clickthrough rate of the spam messages in social network services is higher than spam emails (Grier et al., 2010), which means a relatively high risk user exposed to threats (Gao et al., 2012). Therefore, there have been various implementation cases of spam detection algorithms in email environments (e.g., Anderson et al., 2007; Ramachandran, Feamster

and Vempala, 2007; Zhuang et al., 2008; Li and Shen, 2011) as well as social network service environments (e.g., Benevenuto et al., 2009; Markines, Cattuto and Menczer, 2009; Stringhini, Kruegel and Vigna, 2010; Yardi et al., 2010).

Participants' key emotional responses in situation 3 were three negative ones: disappointment, hate and anger. Notable in the third situation was that hate emerged from all user types. This confirms that the previously mentioned continuous studies on the spam detection algorithms are closely related to the emotion hate.

One notable behavioural response in the third situation was that the vast majority of people simply concluded that the message was spam without reading it. However, the majority of "uninformed" participants showed a tendency to check the other party's profile and to delete the message immediately, while the other three user types mostly ignored the message. The behavioural response of deleting or ignoring spam messages is consistent with recommendations suggested by various cybercrime related organisations such as Fraud and Linked Crime Online (FALCON, <http://content.met.police.uk/Site/falcon>) and National Crime Agency (NCA, <http://www.nationalcrimeagency.gov.uk>). Moreover, the majority of "suspicious" and "neglectful" participants said that they would block the sender if they received spam repeatedly from one sender. However, the majority of "uninformed" participants showed a tendency to block the sender immediately. Interestingly, more than a half of "uninformed" participants reported to the service immediately. Finally, following the immediate actions, the majority of "trustful" and "suspicious" participants showed a tendency to take precautions against further threats. They checked the privacy settings to determine who could contact them in the future. Similar to the first and second situations, the behavioural responses of precaution shown by "trustful" and "suspicious" participants were consistent with Das and Sahoo's (2011) guideline: "Change the profile privacy now".

### ***Situation 4: Surveillance-like Structure***

In the fourth scenario, users received a friend request from a stranger. Given that the stranger was a friend of the participant's friend, the participant appeared to be referred to the stranger by a recommender system provided by the service.

Surprisingly, the key emotion was a positive one: interest. A "friend request" is one of the most effective tools of social network services to explore new friends (Xie, 2010). In fact, the majority of users were intrigued by or disinterested in, rather than averse to, a friend request from a stranger.

A notable behavioural response in the fourth situation was that the vast majority of people showed a tendency to check mutual friends when receiving a friend request. It was possible to confirm that a mutual friend is an important factor that reveals the connection with others (Jin, Joshi and Anwar, 2013). The majority of “trustful” and “neglectful” participants showed a tendency to look over the other party’s profile, activities and photos very actively to find any possible connection with the other party. Some different behavioural responses were found when dealing with the request. More than a half of “uninformed” participants declined the request, whereas the other three user types showed a tendency to ignore the friend request. The behavioural response of ignoring the friend request despite the key emotional response, interest, is also consistent with the advice “Don’t accept friendship request from strangers” suggested by Das and Sahoo (2011). Finally, following the immediate actions, the majority of “trustful” and “suspicious” participants took precautions against further threats. They checked the privacy settings to control who could contact them in the future. Similar to the other situations, the behavioural responses of precaution shown by “trustful” and “suspicious” participants were consistent with Das and Sahoo’s (2011) guideline: “Change the profile privacy now”.

### 5.4 Summary

This chapter has dealt with the second part of the Facebook case study, focusing on exploring how the classified user types of Facebook differently responded in terms of emotion and behaviour in identical situations of privacy infringement. Each user type’s key emotional and behavioural responses were identified by privacy infringement situation, such that the synthesised outcomes of the Facebook case study could contribute to the development of persona models of each Facebook user type. The main findings are as follows:

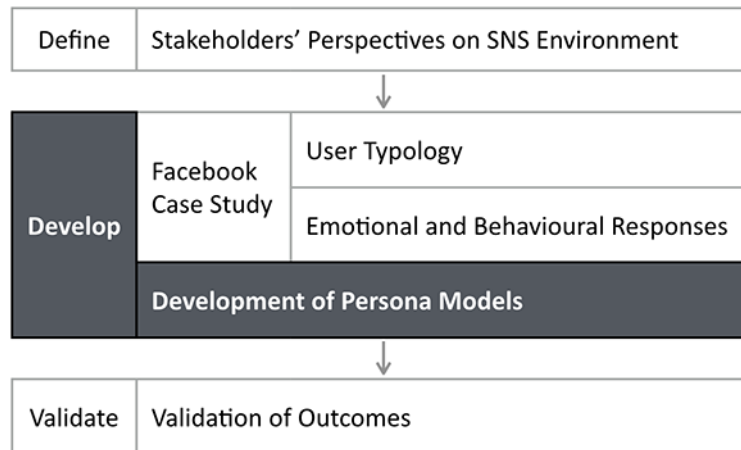
- **Situation 1 (Inadvertent Disclosure of Personal Information):** In the first scenario for the experiment, one of the participant’s friends disclosed the participant’s bank account details publicly. Participants’ key emotional responses were disappointment, fear, hate and anger. Disappointment emerged from all user types. Notable behavioural responses were that (1) “trustful” and “suspicious” participants grasped the situation very readily, (2) all user types deleted the disclosed information immediately, (3) “suspicious” and “uninformed” participants stressed that they would directly make a phone call, send a SMS or email to prevent further risks, (4) “suspicious” participants checked for further damage due to the disclosure and (5) “trustful” and “suspicious” participants took precautions against further threats.
- **Situation 2 (Damaged Reputation Due to Rumours/Gossip):** In the second scenario, the participant’s reputation might be damaged due to some humiliating

photos being posted online. Participants' key emotional responses were sadness, guilt, regret, shame, disappointment, disgust, hate and anger. Shame emerged from all user types. Notable behavioural responses were that (1) "trustful" and "suspicious" participants grasped the situation very actively, (2) all user types removed the tags from the photos, (3) "suspicious" and "uninformed" participants removed tags from all photos, whereas the other two user types removed tags only from selected photos, (4) "suspicious" and "uninformed" participants said that they would directly make a phone call and (5) "trustful" and "suspicious" participants took precautions against further threats.

- **Situation 3 (Unwanted Contact and Harassment/Stalking):** In the third scenario, participants received regular spam messages. Participants' key emotional responses were disappointment, hate and anger. Hate emerged from all user types. Notable behavioural responses were that (1) the vast majority of participants simply concluded that the message was spam and did not even try to read the message, (2) "uninformed" participants checked the other party's profile, deleted the message, blocked the sender and reported to the service immediately, (3) "suspicious" and "neglectful" participants said that they would block the sender if the action were repeated and (4) "trustful" and "suspicious" participants took precautions against further threats.
- **Situation 4 (Surveillance-like Structure):** In the fourth scenario, participants received a friend request from a stranger. The key emotion was a positive one: interest. The majority of participants might take an interest or pay no attention to such a request. Notable behavioural responses were that (1) the vast majority of participants checked mutual friends, (2) "trustful" and "neglectful" participants looked over the other party's profile, activities and photos very closely, (3) "uninformed" participants declined the request and (4) "trustful" and "suspicious" participants took precautions against further threats.

In the next chapter, the procedure of developing persona models of each Facebook user type will be presented based on the main findings from Chapters 4 and 5.

## Chapter 6. Developing Persona Models



Fifty Facebook users were classified into four distinct types according to their perceptions of privacy in Chapter 4, and each user type's key emotional and behavioural responses were identified in Chapter 5.

This chapter describes the development of persona models. The persona models creation was performed by synthesising the information from the case study and by determining the correlations between the users' perceptions of privacy, key emotional responses and key behavioural responses. The persona models can help software agent designers/developers to better understand users' perspectives towards privacy issues in social network services.

### ***Persona Model***

A persona, introduced by Cooper (1999) by borrowing from marketing research on consumer behaviour, is a tool to model the user experience. It is defined as a fictitious, specific and concrete representation of target consumer groups with common characteristics and needs (Pruitt and Adlin, 2006; Idoughi, Seffah and Kolski, 2012). The persona has been often integrated into the design processes of influential firms (Miaskiewicz and Kozar, 2011) due to the following benefits:

- Increasing focus on the users and their goals (Cooper, 1999);
- Building consensus and commitment to design (Cooper and Reimann, 2003);
- Facilitating effective communication among the users (Grudin and Pruitt, 2002);
- Building empathy for the users (Pruitt and Adlin, 2006);
- Leading to more user-friendly designs (Long, 2009).

Pruitt and Adlin (2006) suggested the following six steps of persona creation:

1. **Identify persona data sources:** It is beneficial to prepare enough direct users because personas are created based on large amount of user data.
2. **Set up user groups:** User groups for products or services can be presented by user role, user goal and user segment.
3. **Collect and analyse user data:** Persona creation team reviews and analyses raw data collected by directly observing users, resulting in “skeletons” that present brief, bulleted and listed user data.
4. **Prioritise persona skeletons:** Persona skeletons can be prioritised in terms of their “frequency of use”, “size of market”, “historical or potential revenue” and “strategic importance”. Prioritising persona skeletons allows to create personas by identifying the importance of different user groups.
5. **Convert skeletons to persona foundation documents:** Personas are created by adding persona’s name, photo and concrete narration of a specific user to the persona skeletons.
6. **Designate persona types:** Persona creation is finalised by designating the persona types such as user persona, customer persona, severed persona and negative persona.

The persona, a fictitious character based on composite archetypes, is a summarised user story based on the actual users’ behavioural data collected by ethnography or empirical studies (Cooper, 1999). For this reason, the persona was considered appropriate to present the outcomes of the Facebook case study.

As mentioned in the persona creation process, the persona provides precise stories of users’ needs within the contexts of specific product or service usage in a “narrative” form (Miaskiewicz and Kozar, 2011). However, the research described in this thesis focused on investigating the differences among social network service user types in terms of their perceptions of privacy, key emotional responses and key behavioural responses. In other words, it was considered more important to represent the differences among user types rather than to narratively describe them. The research described in this thesis therefore proposed each user type’s perceptions of privacy, key emotional responses and key behavioural responses using a “modelled” form with diagrams rather than the “narrative” form, which is labelled a “persona model”. The persona models are expected to enable software agent designers or developers to straightforwardly understand the differences among the user types.

### 6.1 Synthesis of Findings from Case Study

To develop persona models based on the information identified in the case study described in Chapters 4 and 5, participants’ perceptions of privacy, key emotional responses and key behavioural responses of the four user types in each privacy infringement situation were



integrated into a table to identify possible correlations. Tables 6.1 to 6.4 present the integrated results by situation, and the same coloured cells indicate that they may be correlated. For example, as presented in Table 6.1, the emotion disappointment and deleting behaviour may be correlated because both the emotional response and the behavioural response emerged from all user types (blue cells). Therefore, the deleting behaviour might be influenced by the emotion disappointment.

### 6.1.1 Situation 1: Inadvertent Disclosure of Personal Information

Table 6.1 presents the integrated results of perceptions of privacy, key emotional responses and key behavioural responses in the first situation.

[Table 6.1] Situation 1: Integrated results of perceptions of privacy, key emotional responses and key behavioural responses

		Uninformed	Trustful	Suspicious	Neglectful	
<b>Perceptions of Privacy</b>	Privacy Awareness	Very Low	Average	Very High	Very High	
	Trust/Carelessness	Average	Very High	Very Low	Average	
	Responsibility	Average	Very High	Very High	Very Low	
<b>Emotional Response</b>	Disappointment	✓	✓	✓	✓	
	Fear			✓		
	Hate	✓		✓	✓	
	Anger	✓		✓		
<b>Behavioural Response</b>	<b>Perception</b>	Check time		✓	✓	
		Check the number of like/comment		✓	✓	
		Check who can see		✓	✓	
	<b>Immediate Action</b>	Delete	✓	✓	✓	✓
		Send message in Facebook		✓		✓
		Contact directly	✓		✓	
		Check damage			✓	
<b>Precaution</b>	Privacy settings		✓	✓		
	Timeline settings		✓	✓		

Cautiousness might restrict individual willingness to transact or interact online with others (Metzger, 2004; Van Dyke, Midha and Nemati, 2007). Therefore, it could be inferred that “suspicious” participants’ low trust/carelessness (i.e., high cautiousness) triggered fear in this situation. According to Lamia (2012), fear is “a reaction to something immediate that threatens ... security or safety” and it motivates people to protect themselves. Therefore, “suspicious” participants’ behavioural response of checking for further damage could have been triggered by fear (red cells).

As mentioned in Section 4.3.1, “responsible for information protection” would mean that social network service users have a duty to protect their own personal information in

cyberspace. Given that “trustful” and “suspicious” participants tried to grasp the situation very actively and take precaution against further threats, it appears that the two user types’ behavioural responses are related to their highly responsible personalities (green cells).

According to Lamia (2012), disappointment is “the experience of sadness involving unfulfilled hope”, which means people accept reality and give up having hope when they are disappointed. Therefore, all user types’ behavioural response of deleting the disclosed personal information could be inferred that they accepted the situation which had already happened (blue cells).

Finally, when people feel anger, they tend to blame someone else for causing an event rather than blaming themselves (Lamia, 2012). It is consistent with the “uninformed” and “suspicious” participants’ behavioural response of directly making contact with the source of the disclosure (purple cells).

### 6.1.2 Situation 2: Damaged Reputation Due to Rumours/Gossip

Table 6.2 presents the integrated results of perceptions of privacy, key emotional responses and key behavioural responses in the second situation.

[Table 6.2] Situation 2: Integrated results of perceptions of privacy, key emotional responses and key behavioural responses

		Uninformed	Trustful	Suspicious	Neglectful	
<b>Perceptions of Privacy</b>	Privacy Awareness	Very Low	Average	Very High	Very High	
	Trust/Carelessness	Average	Very High	Very Low	Average	
	Responsibility	Average	Very High	Very High	Very Low	
<b>Emotional Response</b>	Sadness			✓		
	Guilt			✓		
	Regret	✓		✓	✓	
	Shame	✓	✓	✓	✓	
	Disappointment	✓		✓	✓	
	Disgust	✓		✓		
	Hate	✓		✓	✓	
	Anger	✓		✓		
<b>Behavioural Response</b>	<b>Perception</b>	Check time		✓	✓	
		Check the number of like/comment		✓	✓	
		Check who can see		✓	✓	
	<b>Immediate Action</b>	Delete (All)	✓		✓	
		Delete (Selected)		✓		✓
		Send message in Facebook		✓		✓
		Contact directly	✓		✓	
	<b>Precaution</b>	Privacy settings		✓	✓	
		Timeline settings		✓	✓	

According to Lamia (2012), sadness is an emotional response when people are disconnected from someone or something that they had valued, and guilt is a social and self-conscious emotion of discomfort when people intentionally or unintentionally hurt others physically or emotionally. Cautiousness might restrict individual willingness to transact or interact online with others (Metzger, 2004; Van Dyke, Midha and Nemati, 2007). Therefore, it could be inferred that “suspicious” participants’ low trust/carelessness (i.e., high cautiousness) triggered sadness and guilt in this situation, because they may have thought that they were disconnected from the uploader and that the situation could hurt someone emotionally due to the uncomfortable situation (red cells).

As mentioned in Section 4.3.1, “responsible for information protection” would mean that social network service users have a duty to protect their own personal information in cyberspace. Given that “trustful” and “suspicious” participants tried to grasp the situation very actively and take precaution against further threats, it appears that the two user types’ behavioural responses are related to their highly responsible personalities (green cells).

Shame most likely caused all four user types’ behavioural response of deleting personal rumours/gossip. Unlike the first situation, participants’ behavioural response of deleting personal rumours/gossip was related to shame rather than disappointment. Given all user types’ emotional response of disappointment excluding “trustful” participants, it could be interpreted that they not only accepted the situation but also wanted to remove the shameful record (blue cells).

However, it was possible to identify two different behavioural responses, either deleting all rumours/gossip or deleting selected ones. In particular, “uninformed” and “suspicious” participants deleted all such messages or posts, and it appears that disgust and anger were related to this behavioural response. Moreover, these two user types stressed that they would directly make a phone call, send SMS or email the source of the rumours/gossip. It appears that this behavioural response was caused by feeling disgust and failing to control their anger in such a situation. Given that shame can trigger disgust and anger (Lamia, 2012), it could be interpreted that “uninformed” and “suspicious” participants’ emotional responses of disgust and anger were triggered by anger, resulted in their behavioural responses of deleting all the records and directly making contact with the source of the disclosure (purple cells).

### **6.1.3 Situation 3: Unwanted Contact and Harassment/Stalking**

Table 6.3 presents the integrated results of perceptions of privacy, key emotional responses and key behavioural responses in the third situation.

[Table 6.3] Situation 3: Integrated results of perceptions of privacy, key emotional responses and key behavioural responses

		Uninformed	Trustful	Suspicious	Neglectful	
<b>Perceptions of Privacy</b>	Privacy Awareness	Very Low	Average	Very High	Very High	
	Trust/Carelessness	Average	Very High	Very Low	Average	
	Responsibility	Average	Very High	Very High	Very Low	
<b>Emotional Response</b>	Disappointment	✓				
	Hate	✓	✓	✓	✓	
	Anger	✓				
<b>Behavioural Response</b>	<b>Perception</b>	Check the other party's profile	✓			
	<b>Immediate Action</b>	Ignore		✓	✓	✓
		Delete	✓			
		Block user immediately	✓			
		Block user if repeated			✓	✓
		Report to Facebook immediately	✓			
	<b>Precaution</b>	Privacy settings		✓	✓	

Acquisti and Gross (2006) have claimed that privacy awareness is affected by users' frequency of updates, thus that privacy awareness gradually increases with time and experience. Given this characteristic, most newcomers could be considered "uninformed" users because they would inevitably have the least experience in using Facebook compared to other users. This may triggered "uninformed" participants' emotional responses of disappointment and anger even though this situation occurs very often in social network services. They also checked the other party's profile, responded to the other party's contact, blocked the user and reported to Facebook immediately. In other words, "uninformed" participants showed relatively sensitive reactions to this situation. It appears that these behavioural responses were influenced by their low "privacy awareness" and average "responsibility" (red cells).

On the other hand, "suspicious" and "neglectful" participants stressed in their ethnographic responses that they would block the user if the situation occurred again. They managed the situation without being disconcerted probably because the two user types were relatively high in "privacy awareness" (green cells).

As mentioned in Section 4.3.1, "responsible for information protection" would mean that social network service users have a duty to protect their own personal information in cyberspace. Given that "trustful" and "suspicious" participants tried to take precaution against further threats, it appears that the two user types' behavioural responses are related to their highly responsible personalities as in the previous situations (purple cells).

### 6.1.4 Situation 4: Surveillance-like Structure

Table 6.4 presents the integrated results of perceptions of privacy, key emotional responses and key behavioural responses in the fourth situation.

[Table 6.4] Situation 4: Integrated results of perceptions of privacy, key emotional responses and key behavioural responses

		Uninformed	Trustful	Suspicious	Neglectful
<b>Perceptions of Privacy</b>	Privacy Awareness	Very Low	Average	Very High	Very High
	Trust/Carelessness	Average	Very High	Very Low	Average
	Responsibility	Average	Very High	Very High	Very Low
<b>Emotional Response</b>	Interest		✓		✓
<b>Behavioural Response</b>	Check mutual friends	✓	✓	✓	✓
	Check the other party's profile		✓		✓
	Check the other party's activities		✓		✓
	Check the other party's photos		✓		✓
	<b>Immediate Action</b>	Ignore		✓	✓
	Respond	✓			
<b>Precaution</b>	Privacy settings		✓	✓	

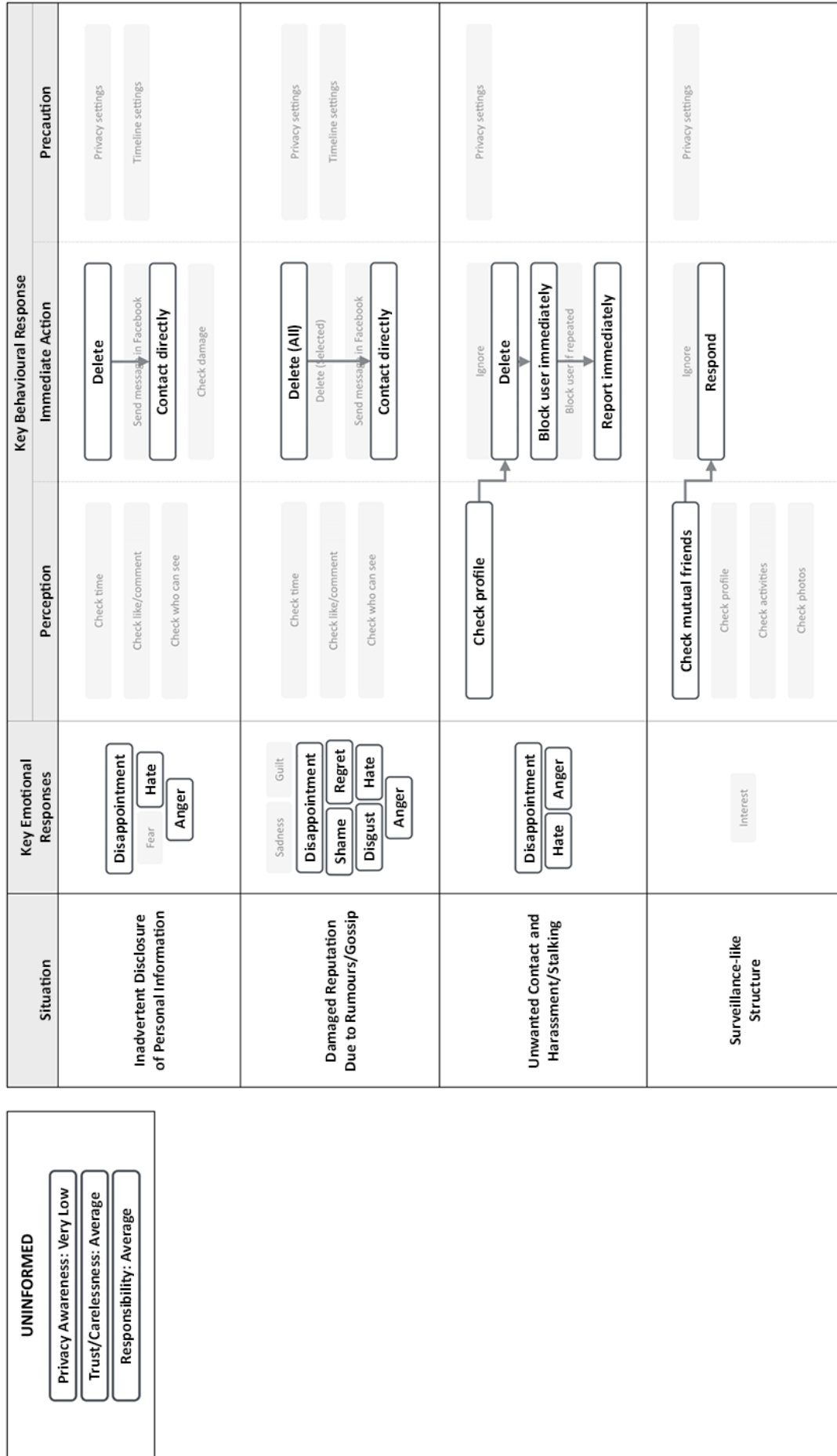
Acquisti and Gross (2006) have claimed that privacy awareness is affected by users' frequency of updates, thus that privacy awareness gradually increases with time and experience. Given this characteristic, most newcomers could be considered "uninformed" users because they would inevitably have the least experience in using Facebook compared to other users. As in the previous section, "uninformed" participants responded to the other party's surveillance-like activities, while the other user types had ignored such activities. It also appears that the lowest "privacy awareness" and average "responsibility" caused this behavioural response, because receiving friend requests from strangers is also a very common experience in social network services (red cells).

As mentioned in Section 4.3.1, "responsible for information protection" would mean that social network service users have a duty to protect their own personal information in cyberspace. Given that "trustful" and "suspicious" participants tried to take precaution against further threats, it appears that the two user types' behavioural responses are related to their highly responsible personalities as in the previous situations (green cells).

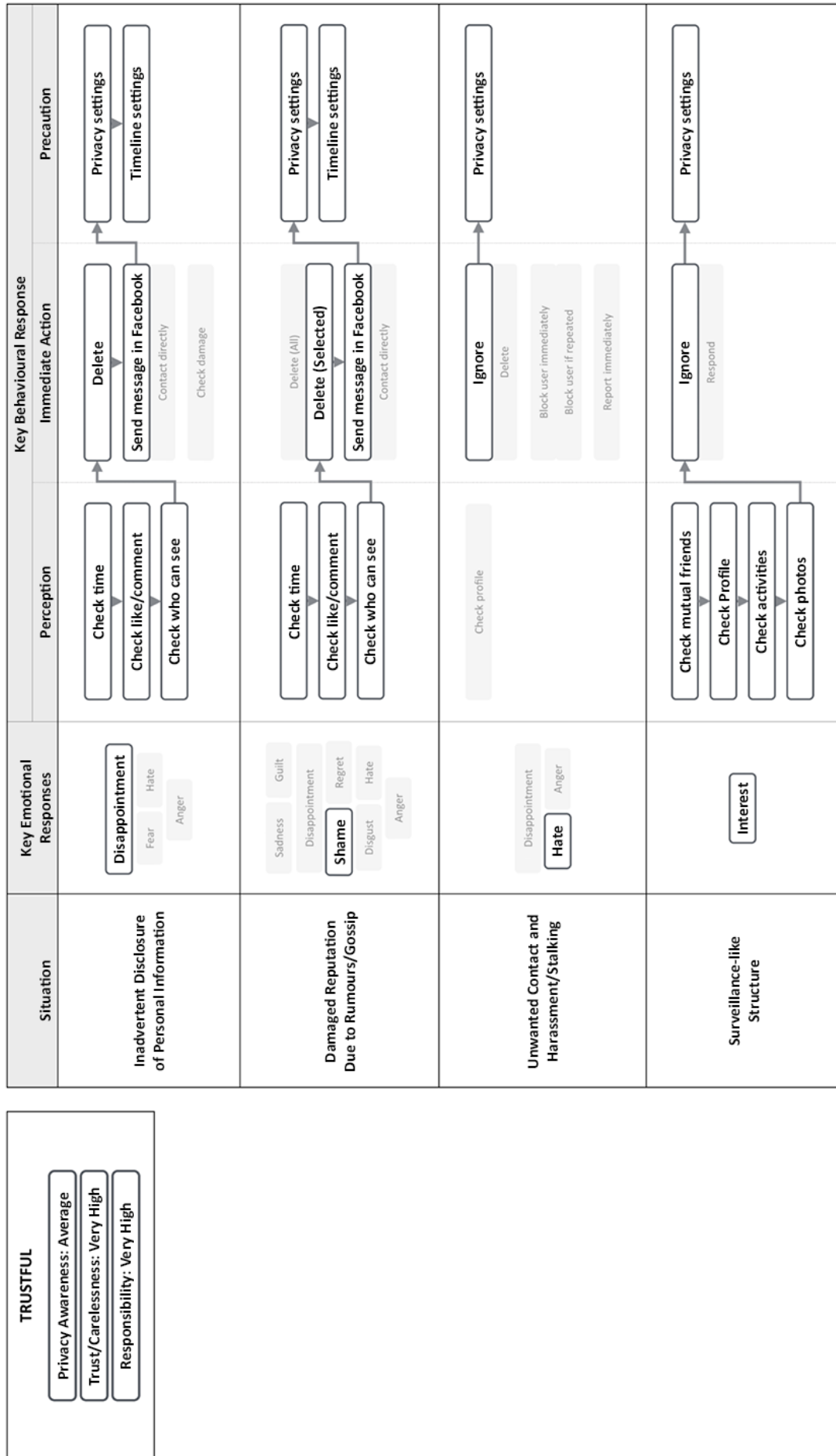
Finally, "trustful" and "neglectful" participants checked the other party's profile, friends list, activities and photos very actively. According to Keltner and Lerner (2010), interest is triggered when people experience a pleasant and desired situation or event. Interest is thus usually associated with the enjoyment of an activity (Lamia, 2012). Given that interest emerged from the two user types, it appears that they enjoyed the fundamental benefit of social network services, namely communicating and socialising with others (purple cells).

## 6.2 Development of Persona Models

Based on the analyses in the previous section, the persona models of each user type were created (Figures 6.1 to 6.4). The small box on the upper-left corner presents the name of the user type and its perceptions of privacy. The bigger box on the right presents the key emotional responses of corresponding user type and workflows of key behavioural responses by situation (white boxes with thick border and bold texts). The grey boxes indicate that they are not the case for the user type. The same coloured boxes in Figures 6.5 to 6.8 particularly highlight the connections between perceptions of privacy, key emotional responses and key behavioural responses of each user type.

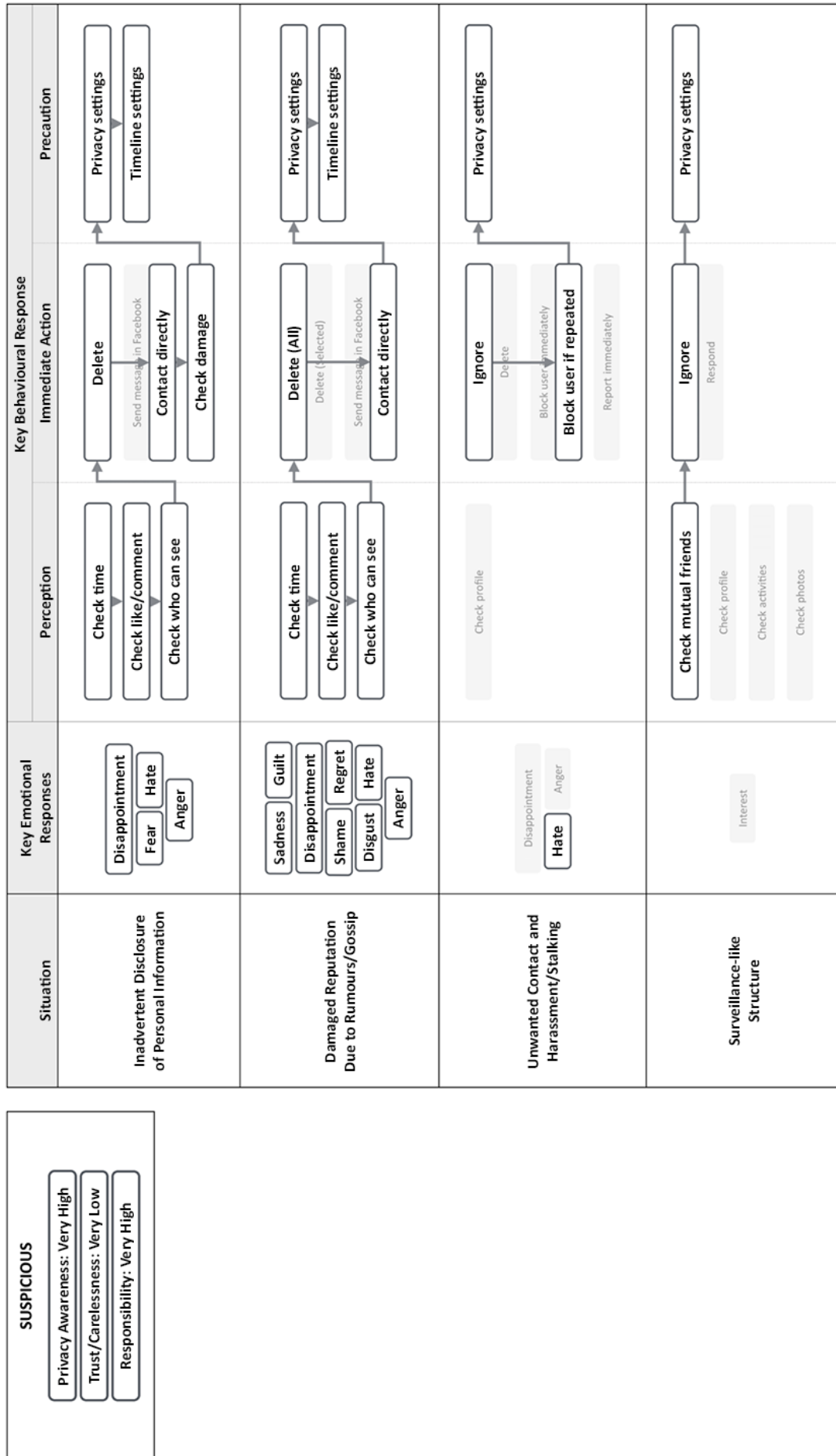


[Figure 6.1] Persona model of “uninformed”



[Figure 6.2] Persona model of “trustful”

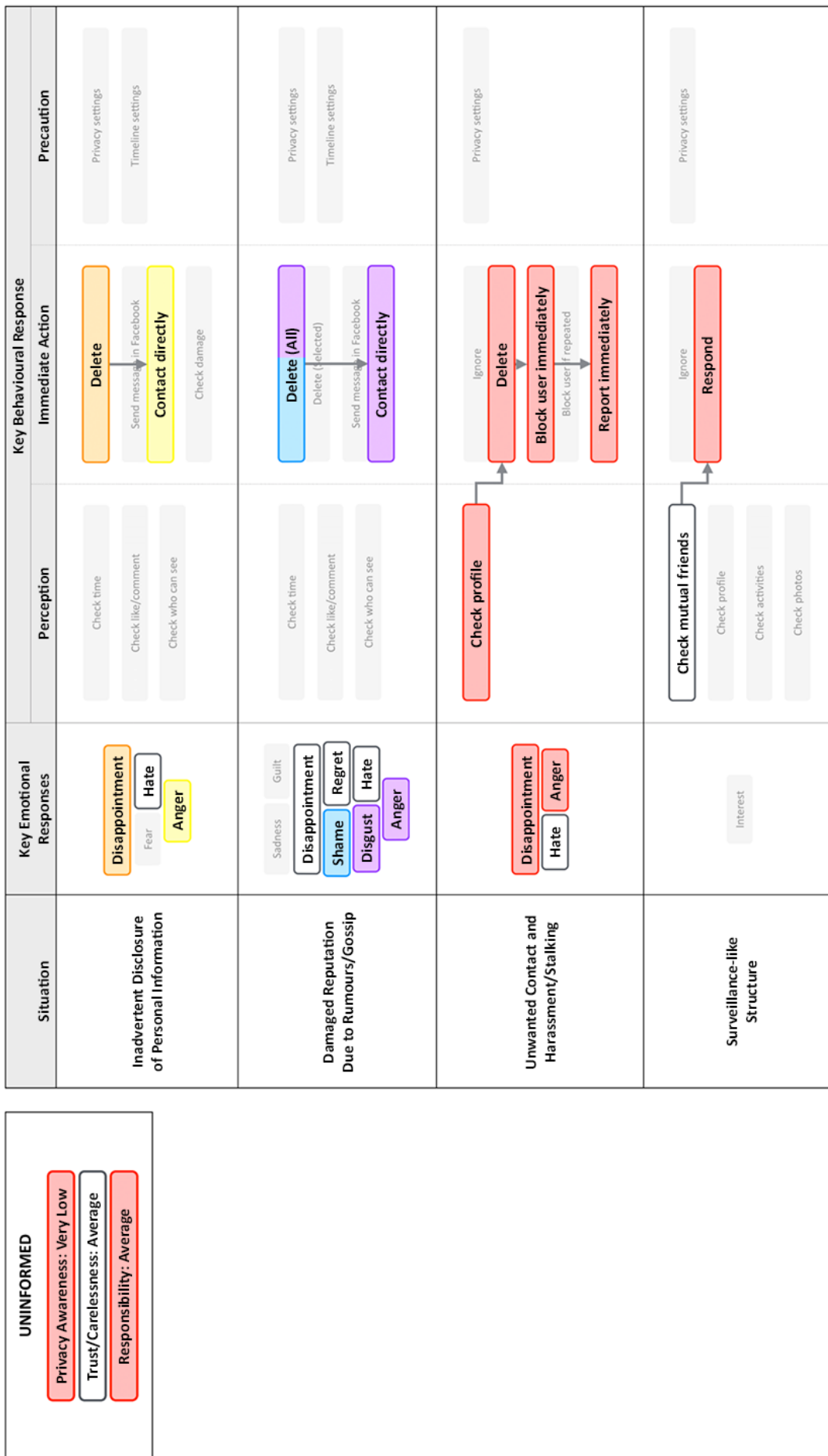




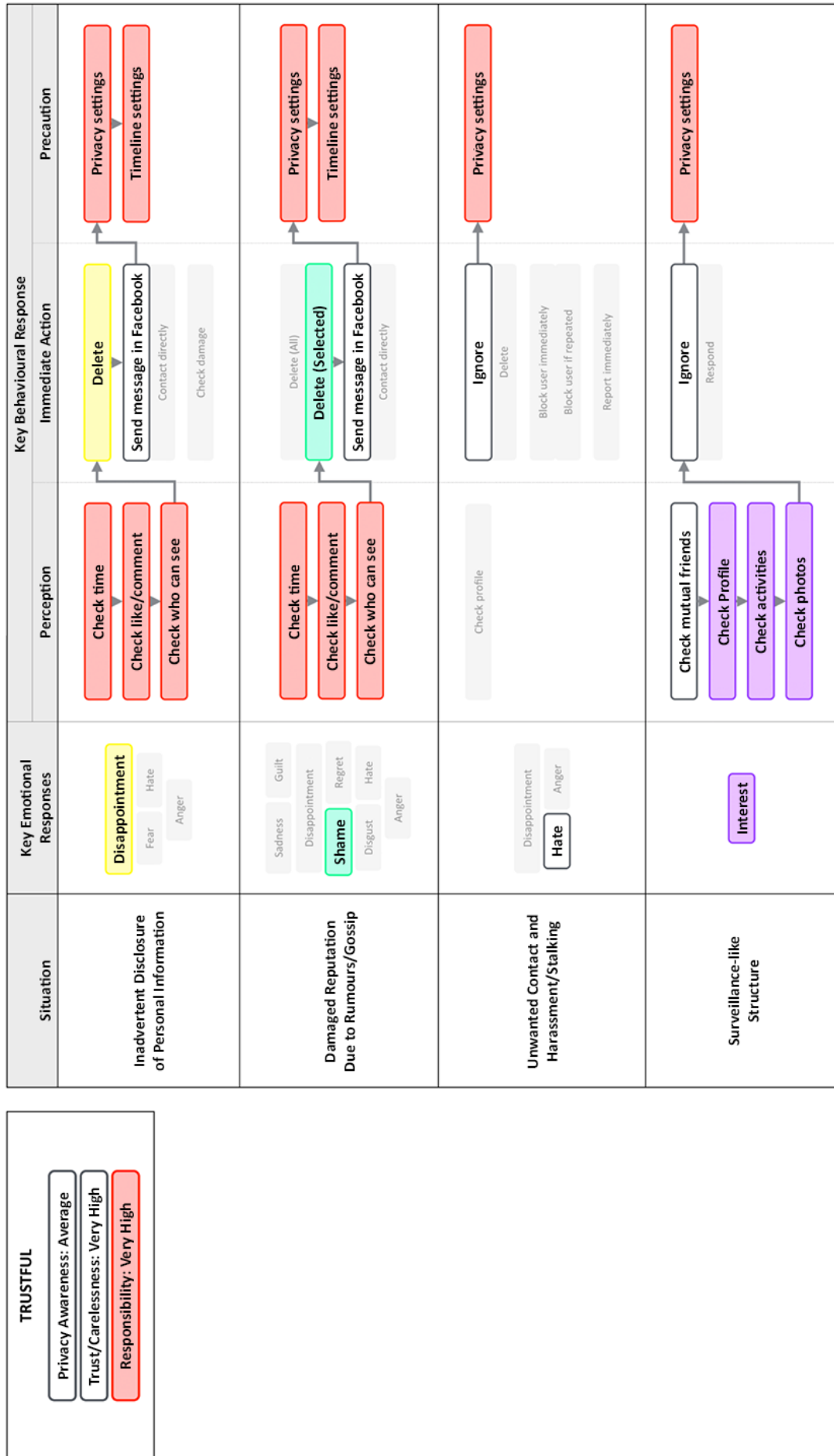
[Figure 6.3] Persona model of “suspicious”

Situation	Key Emotional Responses	Perception	Key Behavioural Response	
			Immediate Action	Precaution
<p><b>NEGLECTFUL</b></p> <p>Privacy Awareness: Very High</p> <p>Trust/Carelessness: Average</p> <p>Responsibility: Very Low</p>	<p><b>Disappointment</b></p> <p>Fear</p> <p><b>Hate</b></p> <p>Anger</p>	<p>Check time</p> <p>Check like/comment</p> <p>Check who can see</p>	<p><b>Delete</b></p> <p><b>Send message in Facebook</b></p> <p>Contact directly</p> <p>Check damage</p>	<p>Privacy settings</p> <p>Timeline settings</p>
<p><b>Damaged Reputation Due to Rumours/Gossip</b></p>	<p>Sadness</p> <p>Guilt</p> <p><b>Disappointment</b></p> <p><b>Shame</b></p> <p>Regret</p> <p><b>Hate</b></p> <p>Disgust</p> <p>Anger</p>	<p>Check time</p> <p>Check like/comment</p> <p>Check who can see</p>	<p>Delete (All)</p> <p><b>Delete (Selected)</b></p> <p><b>Send message in Facebook</b></p> <p>Contact directly</p>	<p>Privacy settings</p> <p>Timeline settings</p>
<p><b>Unwanted Contact and Harassment/Stalking</b></p>	<p>Disappointment</p> <p><b>Hate</b></p> <p>Anger</p>	<p>Check profile</p>	<p><b>Ignore</b></p> <p>Delete</p> <p>Block user immediately</p> <p><b>Block user if repeated</b></p> <p>Report immediately</p>	<p>Privacy settings</p>
<p><b>Surveillance-like Structure</b></p>	<p><b>Interest</b></p>	<p>Check mutual friends</p> <p>Check Profile</p> <p>Check activities</p> <p>Check photos</p>	<p><b>Ignore</b></p> <p>Respond</p>	<p>Privacy settings</p>

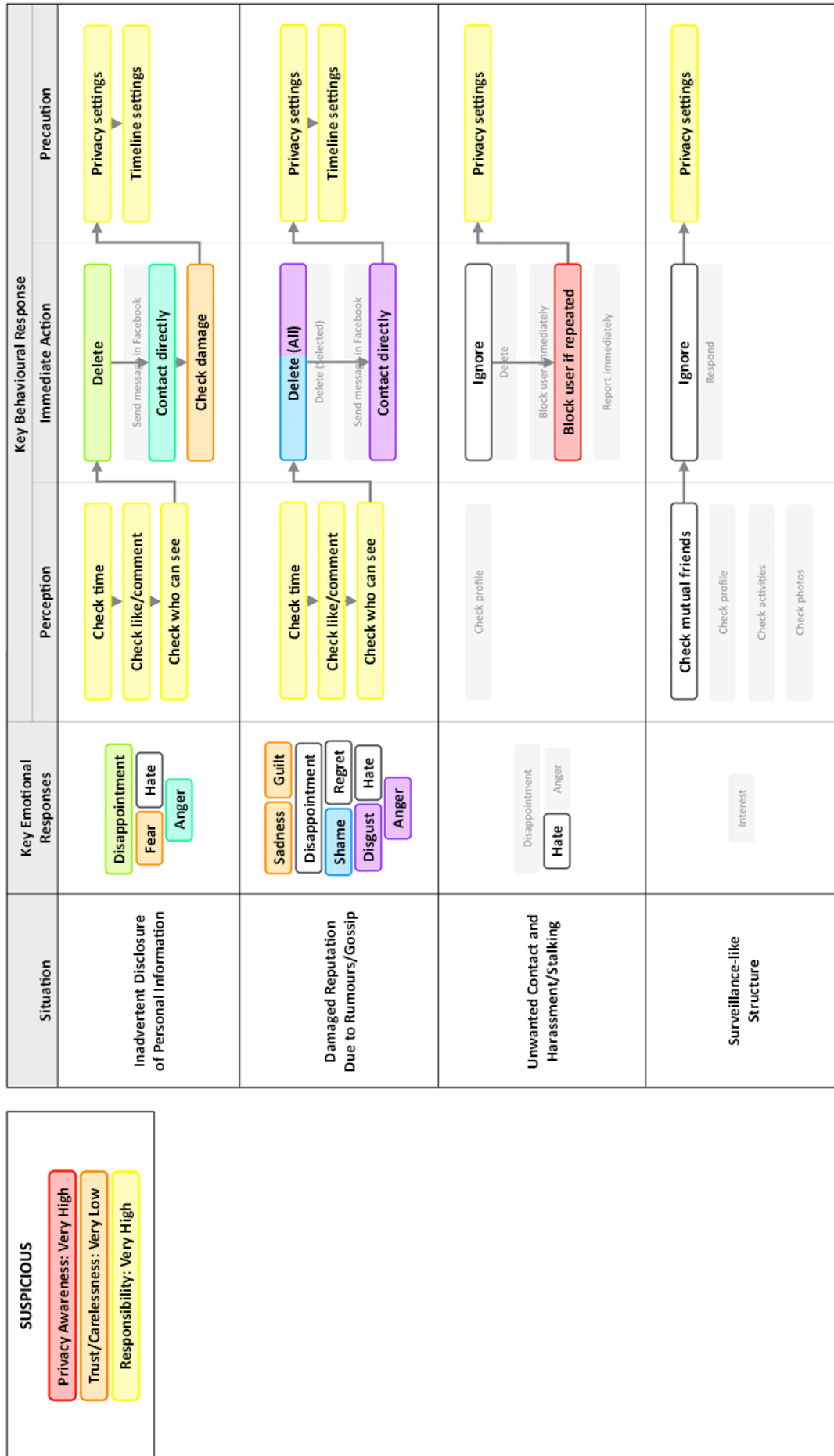
[Figure 6.4] Persona model of “neglectful”



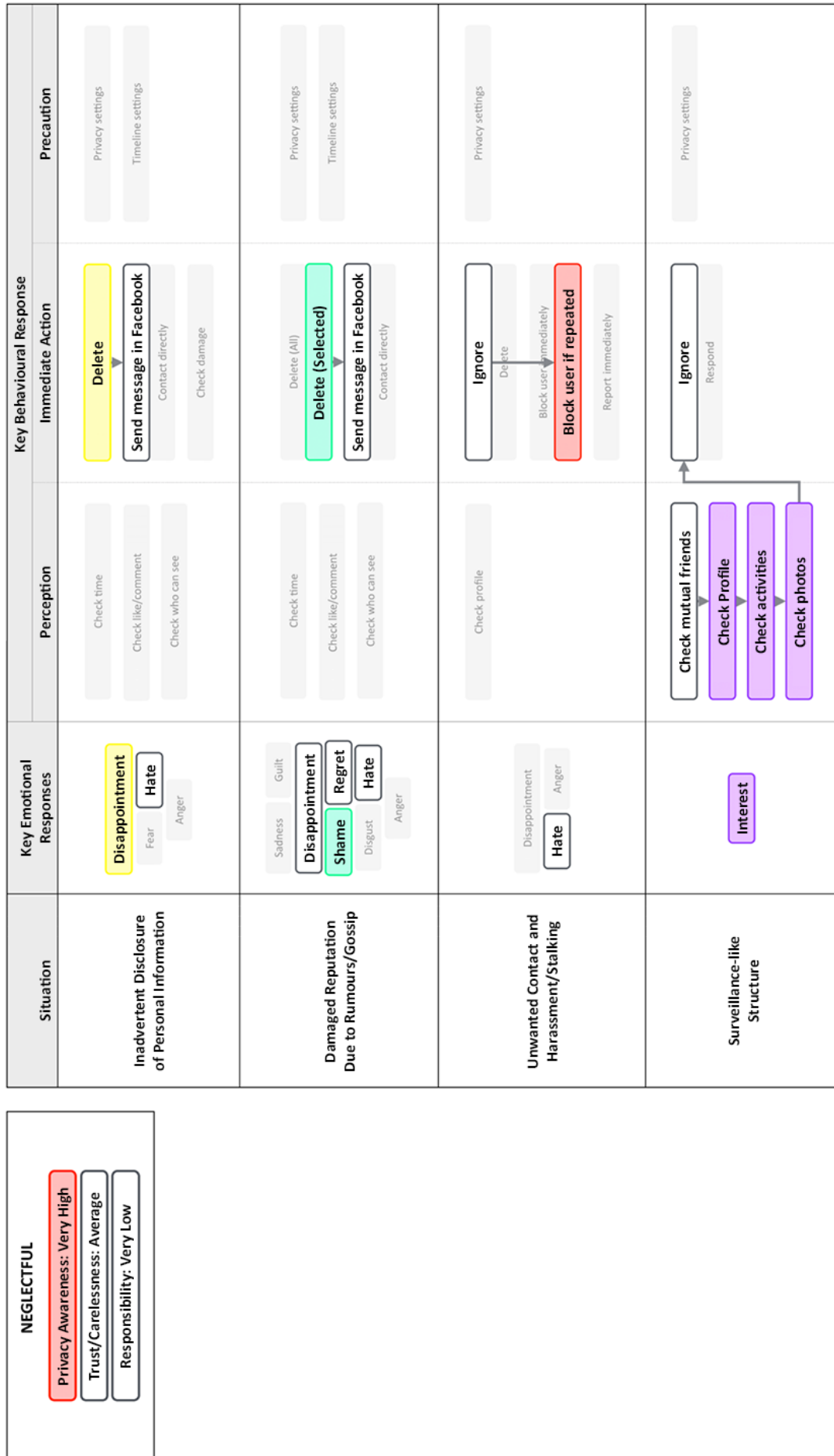
[Figure 6.5] Persona model of “uninformed” (highlighting connections between perceptions of privacy, emotional responses and behavioural responses)



[Figure 6.6] Persona model of “trustful” (highlighting connections between perceptions of privacy, emotional responses and behavioural responses)



[Figure 6.7] Persona model of “suspicious” (highlighting connections between perceptions of privacy, emotional responses and behavioural responses)



[Figure 6.8] Persona model of “neglectful” (highlighting connections between perceptions of privacy, emotional responses and behavioural responses)

### 6.3 Two Different Modes of Software Agent

Looking into the workflows in the persona models shown in Figures 6.5 to 6.8, it was possible to derive how the software agent can benefit users by providing them with appropriate services depending on users' perceptions of privacy, key emotional responses and key behavioural responses. In particular, the software agent would be able to act in two different modes, confirmation and guidance.

#### **Confirmation**

“Confirmation” refers to the software agent’s autonomous and reactive activity that focuses on data-mining of related information and confirming users’ decisions within privacy infringement situations. In each situation, the software agent requests users’ confirmations with regard to their key behavioural responses (white boxes with thick border and bold texts in the workflows in Figures 6.1 to 6.4) before they take action. It is expected to save users’ effort of repeating the key behavioural responses whenever the privacy infringement situations occur.

For example, in the situation of inadvertent disclosure of personal information, “uninformed” users may have felt disappointed and thus deleted the disclosed information (Figure 6.5). Therefore, the software agent may be prepared to delete such sensitive information in advance and ask the users for confirmation. The “confirmation” feature of the software agent would be able to not only prevent the users from failing to notice such sensitive situations, but also minimise the users’ negative emotion, disappointment.

#### **Guidance**

“Guidance” refers to the software agent’s activities that focus on encouraging users to engage in the procedures that were not dominant in the corresponding user type. In each situation, the software agent provides useful tips that were dominant in other user types but not in the corresponding user type (grey boxes in the workflows in Figures 6.1 to 6.4), because these kinds of behaviour may protect their privacy. This should educate those who lack awareness of privacy practices and encourage those who lack the motivation or responsibility to protect their own personal information.

For example, in the situation of inadvertent disclosure of personal information, “uninformed” users did not try to grasp the situation and to take precaution against further threats (Figure 6.5). Since these behaviours were dominant in those who were very responsible for personal information (i.e., “trustful” and “suspicious”), the software agent may recommend these behaviours to “uninformed” users for their privacy. Therefore, the

“guidance” feature of the software agent would be able to encourage the users to protect their own personal information in a responsible manner.

The two proposed fundamental modes of the software agent, confirmation and guidance, were proposed as concrete ideas to protect users’ privacy in social network services. For example, the “confirmation” mode of the software agent will provide users with appropriate services based on their different perceptions of privacy, key emotional responses and key behavioural responses through better understanding them. By providing the “guidance”, the software agent will not only increase “privacy awareness” of “uninformed” users, but also encourage “neglectful” users to revert to either “trustful” or “suspicious” types who are relatively responsible for personal information and diligent about privacy precautions. This should reduce the number of those who are still unaware of privacy practice and those who neglect their accounts, and should expand the size of a user group pursuing sound relationships.

## 6.4 Summary

This chapter has described the development of persona models of each user type by synthesising the identified information in the Facebook case study described in Chapters 4 and 5, and by identifying correlations between users’ perceptions of privacy, key emotional responses and key behavioural responses. The persona models of each user type included the name of the user type and its perceptions of privacy, key emotional responses of the corresponding user type and workflows of key behavioural responses by situation.

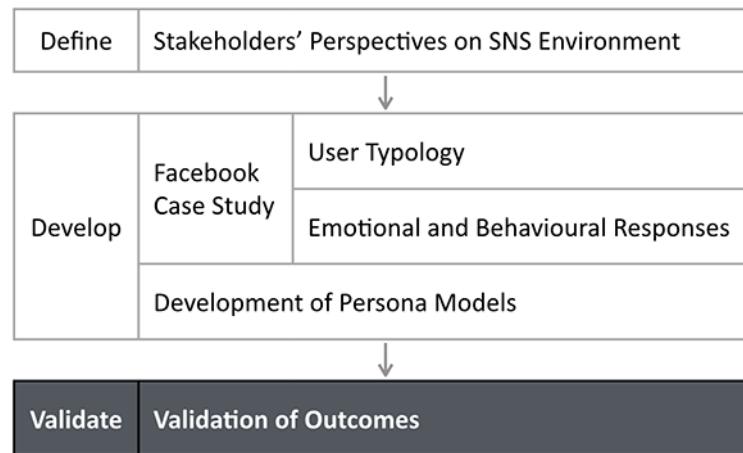
By integrating the results of the case study, it was possible to identify likely connections between perceptions of privacy, key emotional responses and key behavioural responses reflected in the persona models and to suggest two fundamental features of the software agent — confirmation and guidance — that would benefit users in terms of their privacy protection and would maintain the stability of the service. The answers to the research question are therefore suggested as follows:

- **Confirmation:** Software agent’s autonomous and reactive activities that focus on data-mining of related information and confirming users’ decisions within privacy infringement situations to save users’ effort of repeating the key behavioural responses whenever the privacy infringement situations occur.
- **Guidance:** Software agent’s activities that focus on encouraging users to engage in the procedures that were not dominant in the corresponding user type to educate those unaware of privacy practices and to encourage those unable to protect their own personal information.



In the next chapter, the validation of the proposed social network service user typology and persona model-based software agent prototype will be presented.

# Chapter 7. Validating Proposed Social Network Service User Typology and Persona Models



This chapter deals with the validation of the research outcomes through a quantitative approach. Therefore, the main goal of this chapter was to validate the proposed social network service user typology and persona models. For the validation study, software agent prototypes for each user type were developed based on the proposed persona models. The validation process included (1) validating the user typology by replicating user classification and (2) validating the persona models by identifying the changes of key emotional responses after the intervention of the software agent prototypes.

## 7.1 Study Design

### 7.1.1 Persona Model-based Software Agent Prototypes

#### *Rapid Prototyping*

Prototype is a simplified initial sample, model or release of a proposed system that has the following purposes (Luqi and Steigerwald, 1992):

- Formulating and evaluating requirements, specifications and designs;
- Demonstrating feasibility, system behaviour, performance, etc.;
- Identifying and reducing risks of system mis-development;
- Communicating ideas, particularly among diverse groups;
- Answering questions about specific properties of proposed systems.

Among variants of prototyping methods, this study employed a rapid prototyping method, which is often used to quickly represent the most important factors by creating an informal model (Crinnion, 1991), for the following reason:

*“Rapid prototyping is a more effective manner in which to deal with user requirements-related issues, and therefore a greater enhancement to software productivity overall. Requirements can be identified, simulated, and tested far more quickly and cheaply when issues of evolvability, maintainability, and software structure are ignored. This, in turn, leads to the accurate specification of requirements, and the subsequent construction of a valid and useable system from the user's perspective via conventional software development models” (Overmyer, 1991).*

Prototypes are often described as either high or low fidelity prototypes (Exner et al., 2014). The higher the fidelity, the more the prototype resembles the final system in terms of interface design and interaction. One method to develop a low fidelity prototype is paper prototyping (Snyder, 2003), a simple technique that involves creating rough interface sketches on paper. Another method to develop a high fidelity prototype is using software tools specifically designed to create interactive simulations (Overmyer, 1991).

For the validation study, it was necessary to reflect each user type's perceptions of privacy, key emotional responses and key behavioural responses on the software agent. Software agent prototypes were created based on the previously proposed persona models, and were therefore labelled “persona model-based software agent prototypes”. Since the persona models were developed to provide users with tailored services based on their user types, the software agent screens and contents were considered more important than the interaction between the system and participants. The low fidelity prototypes, rather than the interactive simulations, were thus developed by creating non-functional static screens of the software agent using a digital image editor Adobe Photoshop CS6. The Facebook interface was modified for the prototype development because the persona models were based on the results of the Facebook case study.

### ***Pilot Study: Creating Persona Model-based Software Agent Prototypes***

To choose the interface design for the software agent prototypes that most closely reflected the proposed persona models for the main study, a workshop was held with 10 participants: five design researchers and five users. For bias reduction, the number of participants in each group was arranged by the same number.

The prototypes included five design variations of “privacy notification icon and popup” and four design variations of “user type-based software agent” (see Appendix C.1 for the

complete set of design variations, p. 216). After explaining the procedure and outcomes of the Facebook case study, each participant was asked to choose one of the “privacy notification icon and popup” variations and another of the “user type-based software agent” variations that closely reflected the proposed persona models. The second interface design from the “privacy notification and popup” variations (polled seven out of 10 votes) and the second interface design from the “user type-based software agent” variations (polled seven out of 10 votes) were chosen.

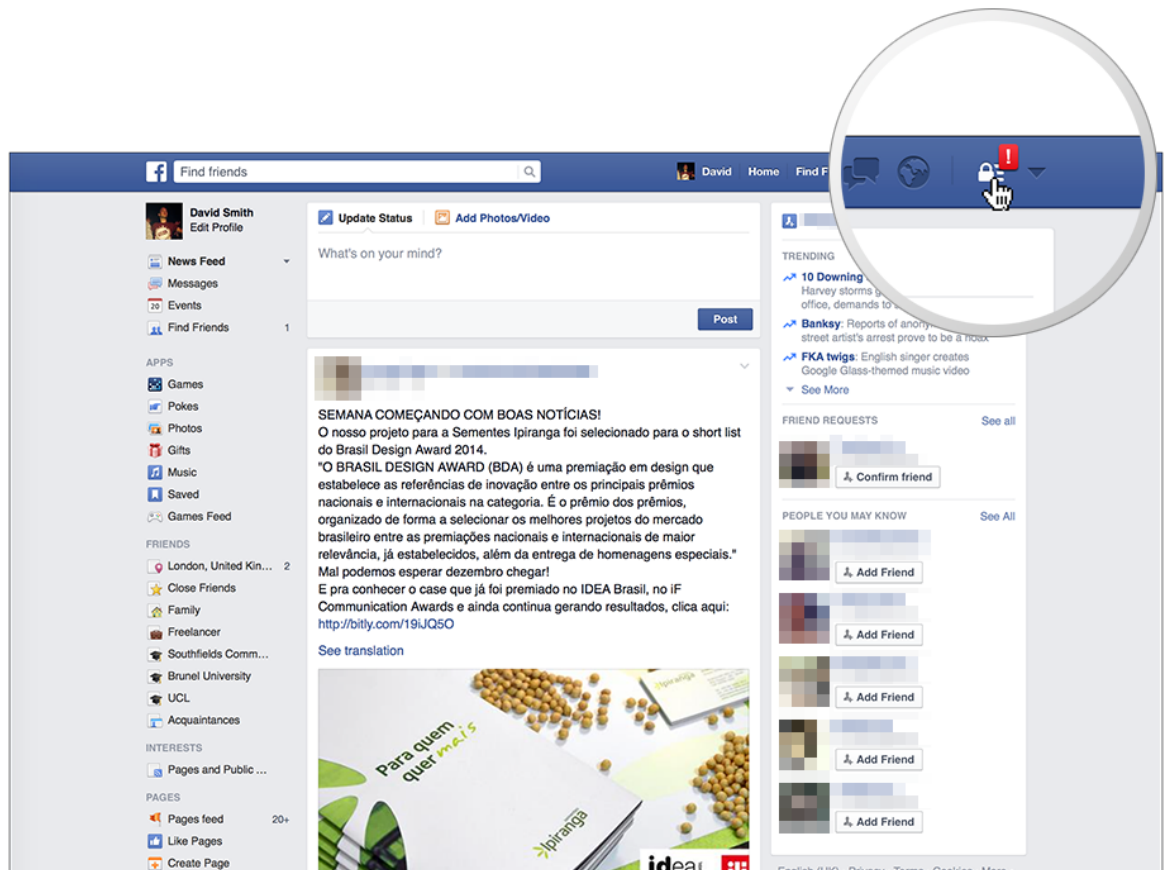
With the chosen interface design, persona model-based software agent prototypes were created for each user type in each privacy infringement situation. The software agent prototypes included different contents of “confirmation” and “guidance” for each user type based on the proposed persona models.

Figures 7.1 to 7.3 present examples of the chosen software agent prototypes. The basic workflow of the prototype interface was as follows:

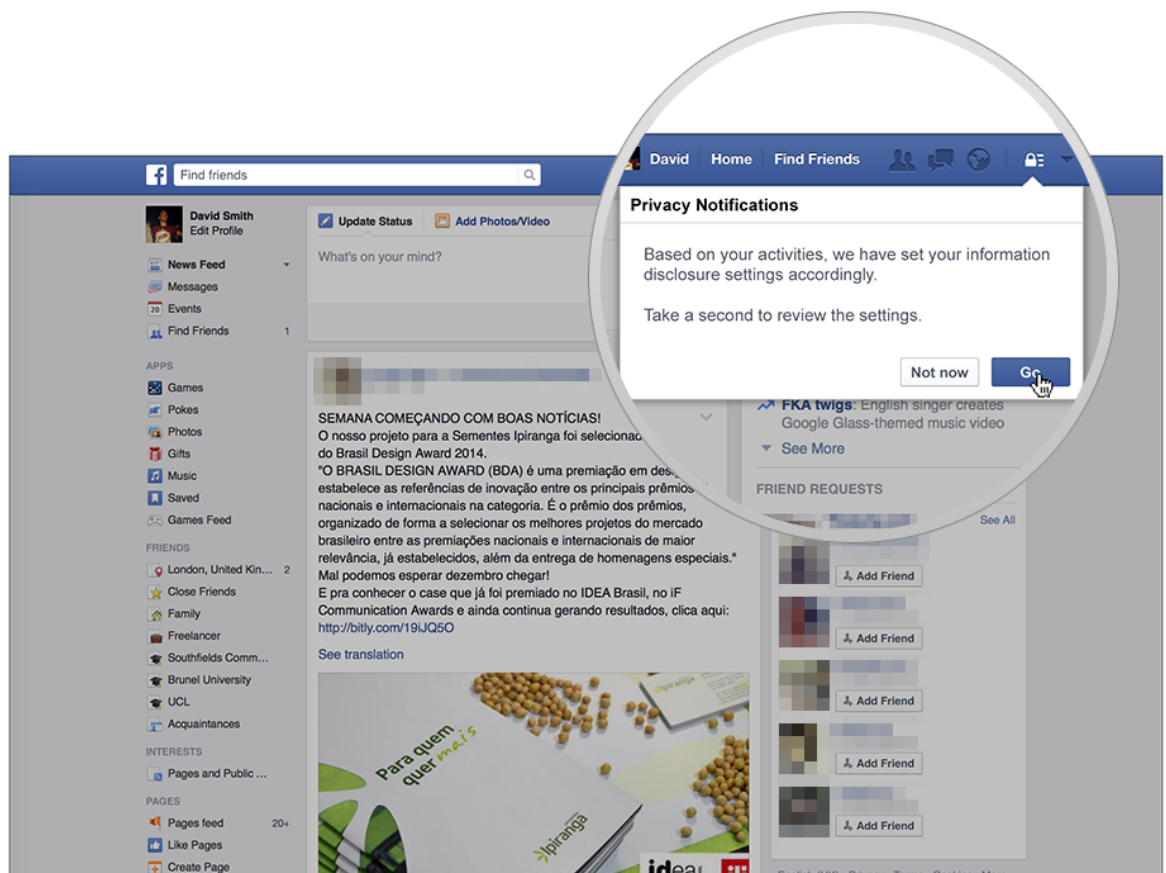
1. **Privacy notification icon:** The privacy notification icon on the upper-right corner shows a red exclamation mark if there is any privacy infringement situation on the user’s account. The user clicks the privacy notification icon (Figure 7.1).
2. **Privacy notification popup:** The privacy notification popup is shown with a brief description of the situation. The popup includes two buttons: “not now” and “go”. The user clicks the “go” button (Figure 7.2).
3. **User type-based software agent:** The user is directed to the corresponding privacy infringement situation. The problematic situation is highlighted and the software agent shows detailed “confirmation” and “guidance” (rephrased to “useful tips” for users) items based on each user type’s persona models (Figure 7.3).

By applying the user interface design chosen in the pilot study, all software agent prototypes were created for the validation study (see Appendix C.2 for the complete set of software agent prototypes for each user type, p. 222).

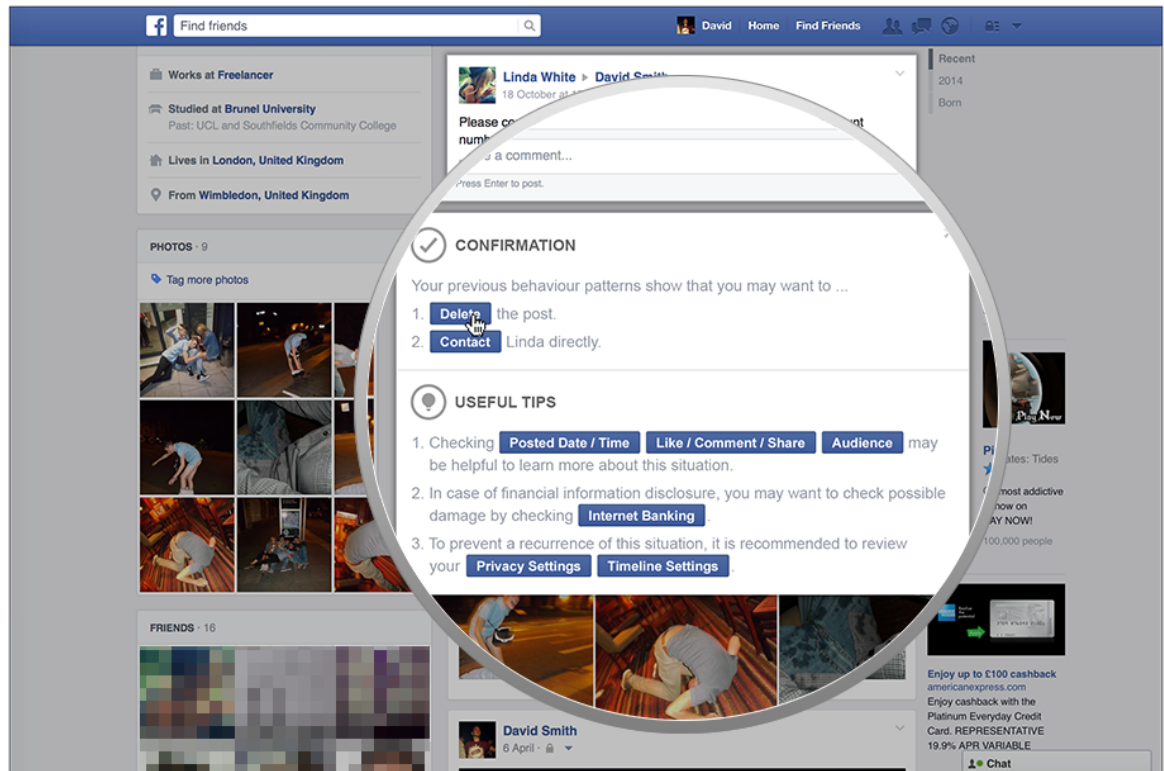
## 7. Validating Proposed SNS User Typology and Persona Models



[Figure 7.1] Software agent prototype 1: Privacy notification icon



[Figure 7.2] Software agent prototype 2: Privacy notification popup



[Figure 7.3] Software agent prototype 3: User type-based software agent

### 7.1.2 Research Approach

In social science research, a quantitative approach is often associated with a positivist perspective (Creswell, 2003). According to Bryman (2004), a quantitative research approach typically involves a deductive method to identify the relationship between theory and research by emphasising the quantification in the collection and the analysis of data. This approach enables generalising the research findings with a large number of samples to test and validate already constructed theories about how a phenomenon occurs and to test hypotheses generated before the data are collected (Johnson and Onwuegbuzie, 2004).

The main goal of this chapter, which deals with the final phase of the research, was to validate the proposed social network service user typology and persona models. First, the user typology was validated by replicating the clustering procedure described in Chapter 4. The hypothesis was that the cluster analysis results of different and larger samples with the identical measurement approach would be consistent with the original study, which is referred to as “reproducibility” (Popper, 1992). Reproducibility in scientific research is often manifested by replication or a repeated instance of an originally performed experiment. This is one of the foundational methods to show that the original results were not an exception, which is a particularly beneficial method for verification and validation (Rand and Wilensky, 2006). Therefore, satisfying the first hypothesis should validate the proposed social network service user typology. Second, the persona models were validated

by identifying the changes in the key emotional responses determined in Chapter 5 after the interventions of the software agent prototypes. The hypothesis was that the negative key emotional responses in situations 1, 2 and 3 would decrease, and the positive key emotional response in situation 4 would increase after participants experience the prototypes. Satisfying the second hypothesis should validate the proposed persona models.

Given the research hypotheses, a quantitative approach was considered appropriate to generalise the research findings with a large number of samples. This chapter therefore describes the validation of the proposed social network service user typology and persona models through a quantitative approach in two steps: (1) validating the user typology by replicating user classification and (2) validating the persona models by identifying the changes of key emotional responses after the intervention of the software agent prototypes.

### 7.1.3 Measures

#### ***Participant Profiling***

The participant profiling included (1) the socio-demographics of gender, age and nationality and (2) the social network service prior usage experience.

#### ***User Typology Measure Based on Perceptions of Privacy***

In order to validate the user typology, the 16 statement questionnaire described in the original study in Chapter 4 was used. The statements, which were adopted from O'Brien and Torres (2012), were related to privacy awareness, trust/carelessness and responsibility (Table 7.1).

The rating scales were six-level Likert scales (from strongly disagree to strongly agree). Although Likert scales are often considered the ordinal level of measurement and treating Likert scales as interval scales has long been controversial (Jamieson, 2004; Norman, 2010), it was presumed that the intervals between values were equal in order to analyse data by parametric test methods, if applicable.

[Table 7.1] The questionnaire statements related to privacy awareness, trust/carelessness and responsibility (Source: O'Brien and Torres, 2012)

Category	Item	Statement
Privacy Awareness	PP1	My name and profile picture on Facebook are not protected under the privacy settings.
	PP2	Whenever I share information on Facebook, I can control exactly who can see it.
	PP3	Information set to 'everyone' on Facebook in the privacy settings is available to everyone on the Internet, not just Facebook users.
	PP4	Using the games and applications means I am making my information available to someone other than Facebook.
	PP5	My friends' activities on Facebook can result in my information being made available to other companies and websites.
	PP6	Facebook does not share information with third parties.
Trust/ Carelessness	PP7	I am cautious in what I say and do on Facebook.
	PP8	I do not think about privacy issues when online.
	PP9	I trust Facebook with my information.
	PP10	I trust my Facebook friends with my information.
	PP11	I trust friends of friends with my information.
	PP12	I trust other Facebook users with my information.
Responsibility	PP13	Trust issues are likely to cause Facebook users to question what they say and do on Facebook.
	PP14	Trust issues are likely to cause Facebook users to change what they say and do on Facebook.
	PP15	It is my responsibility to protect my information on Facebook.
	PP16	It is Facebook's responsibility to protect my information on Facebook.

### ***Changes of Key Emotional Responses***

Similarly to the original study in Chapter 5, key emotional responses were measured by the self-assessment method. However, the key emotional responses in the original study differed between each privacy infringement situation. Therefore, the measured key emotional responses in this chapter were also different in each situation (Table 7.2). For this reason, the full template of the Geneva Emotion Wheel was not given to participants, but the list of emotion words in Table 7.2 were presented instead (six-level rating scales from 0 to 5). In order to identify the changes, key emotional responses were measured within the current Facebook interface first, then measured again after participants had experienced the software agent prototypes.

The rating scales were six-level Likert scales (from 0 to 5). In the same way with the user typology measure, it was presumed that the intervals between values were equal in order to analyse data by parametric test methods, if applicable.



[Table 7.2] Measured key emotional responses in each situation

Situation	Measured Key Emotional Response	Situation	Measured Key Emotional Response
Inadvertent Disclosure of Personal Information	Disappointment Fear Hate Anger	Unwanted Contact and Harassment/Stalking	Disappointment Hate Anger
Damaged Reputation Due to Rumours/Gossip	Sadness Guilt Regret Shame Disappointment Disgust Hate Anger	Surveillance-like Structure	Interest

#### 7.1.4 Sampling and Data Collection Procedure

Prior to recruiting participants and collecting data, the research ethics approval was applied for and granted by the University Research Ethics Committee. This validation study targeted anyone who used Facebook; thus, recruiting of participants was also performed within Facebook. In particular, the invitation, which included the URL of the survey, was posted to the author's personal page and group pages such that it could be distributed to as many connections as possible, including the author's colleagues and acquaintances. The URL was shared by the author's connections, providing visibility to their own connections. This procedure was performed repeatedly in order to distribute the URL as widely as possible, which is referred to as "snowball sampling" (Goodman, 1961).

Snowball sampling is one of several chain-referral sampling strategies to collect data by using existing social structures (Bhutta, 2012). Although it is a useful technique to identify a hidden population, the strategy is weak in terms of leading to an inevitably biased sample (David and Sutton, 2011). Despite this weakness, Bhutta (2012) in her study offered Facebook as a useful snowball sampling frame for the following reasons:

- Facebook's size and growing popularity;
- Quickness and ease of users' social communication occurring through private messages and public posts;
- Effectiveness of recruitment using the group feature;
- Worldwide users to mitigate cultural bias.

A total of 225 participants participated in the survey. Among them, 19 participants' incomplete responses were omitted, and a total of 206 participants' completed responses were used for the analysis. The 206 participants (Male: 100, Female: 106) ranged in age

from 19 to 64 and were from various countries (e.g., Belgium, France, Germany, Greece, Malaysia, Netherlands, Poland, South Korea, Spain, UK, USA).

The data collection was performed in February and March 2015 using the online survey service SurveyMonkey (<http://www.surveymonkey.com>). As different software agent prototypes needed to be presented to participants depending on their user types, the data collection consisted of two steps. The first part of the survey included an informed consent form for participants to indicate voluntary participation, and answer participant profiling questions and user type identification questions. At the end of the first survey, all the participants were asked to provide their email addresses so that they could receive the URL of the second survey. After identifying participants' user types based on the data analysis of the first survey, the URL of the second survey corresponding to the identified user type was sent to each participant by email. The second survey included the key emotional response measurements in privacy infringement situations on Facebook before and after the intervention of the software agent prototypes. In each situation, participants were asked to self-assess the presented emotional responses immediately after they had confirmed the situation and experienced the software agent prototypes within 15 seconds, which would be within the confines of human short-term memory suggested by Baddeley (1992; 1997). It took approximately 30 minutes for each participant to complete both parts of the survey.

### **7.1.5 Data Analysis**

Statistical analysis methods using IBM SPSS Statistics 22 (Burns and Burns, 2008; Hair et al., 2010; Pallant, 2010; Mooi and Sarstedt, 2011; Green and Salkind, 2012) were conducted to classify the participants into groups and to evaluate the changes in key emotional responses in privacy infringement situations on Facebook after the intervention of the software agent prototypes.

#### ***User Typology***

A cluster analysis method described in Section 4.1.5 was conducted again to compare the replicated results to the original study. However, the hierarchical cluster analysis procedure was omitted because this validation study particularly compared the replicated results of the cluster centres to the original study. The same number of clusters was therefore applied for the k-means cluster analysis (see Section 4.1.5 for the details of cluster analysis).

### ***Key Emotional Responses***

In general, the paired-samples  $t$  test, a parametric statistical analysis method used to evaluate whether the mean between two variables is significantly different from zero (Green and Salkind, 2012), is conducted to determine changes in data after an intervention in the same group. There is an assumption underlying paired-samples  $t$  test: difference scores are normally distributed in the population. If the assumption of normality is violated, a non-parametric test such as a sign test or Wilcoxon signed-rank test (Wilcoxon, 1945) is conducted as an alternative (Green and Salkind, 2012). The sign test examines only the number of positive and negative differences, which means it does not consider how different the values of the data are. On the other hand, the Wilcoxon signed-rank test uses the rank of differences, which means it examines the content of differences. Thus, the Wilcoxon signed-rank test is considered more powerful than the sign test (Whitley and Ball, 2002).

The normality test revealed that not all difference scores of key emotional responses were normally distributed ( $p < 0.05$ , see Appendix C.4 for the complete results, p. 235) in each situation. Therefore, the changes in participants' key emotional responses were evaluated by the Wilcoxon signed-rank test, and median values were used as representative values instead of mean values for the analysis (Green and Salkind, 2012).

## **7.2 Results**

### **7.2.1 User Typology Validation: Cluster Analysis Replication**

#### ***Factor Analysis and Reliability Analysis***

Prior to classifying the participants, factor analysis and reliability analysis were conducted in the same manner as was used in the original study. The principal component analysis method was used to extract a set of latent factors (Pallant, 2010), and the varimax rotation method was used to improve the interpretability and scientific utility of the solution (Hair et al., 2010). After factor analysis, reliability analysis was conducted to estimate the degree to which the set of indicators on a latent construct was internally consistent (Hair et al., 2010). Table 7.3 presents the summary of the factor analysis and reliability analysis.

[Table 7.3] Summary of factor analysis and reliability analysis

Item	Factor Analysis			Reliability Analysis		
	Factor Loadings			Communality	Alpha if Item Deleted	Cronbach's Alpha
	Privacy Awareness	Trust/Carelessness	Responsibility			
PA1	<b>0.858</b>	-0.080	0.046	0.744	0.840	<b>0.877</b>
PA2	<b>0.856</b>	-0.070	0.010	0.738	0.839	
PA5	<b>0.833</b>	-0.064	-0.017	0.699	0.850	
PA4	<b>0.810</b>	-0.014	0.061	0.661	0.852	
PA3	<b>0.706</b>	0.046	0.042	0.503	0.877	
PA6_R	<b>0.639</b>	-0.260	0.164	0.503	0.877	
TC6	-0.075	<b>0.897</b>	-0.138	0.830	0.886	<b>0.914</b>
TC1_R	-0.022	<b>0.875</b>	-0.084	0.772	0.892	
TC5	-0.094	<b>0.853</b>	-0.122	0.751	0.893	
TC2	0.044	<b>0.812</b>	0.055	0.665	0.905	
TC4	-0.070	<b>0.797</b>	0.089	0.648	0.905	
TC3	-0.173	<b>0.761</b>	0.043	0.611	0.910	
R3	0.128	-0.022	<b>0.830</b>	0.706	0.687	<b>0.785</b>
R4_R	0.092	-0.039	<b>0.765</b>	0.595	0.738	
R2	0.104	-0.037	<b>0.762</b>	0.593	0.737	
R1	-0.104	0.012	<b>0.745</b>	0.565	0.763	
Eigenvalue	3.825	4.259	2.498			
% of Variance	23.908	26.620	15.610			

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.799, which is considered “good” (Kaiser, 1974; Hutcheson and Sofroniou, 1999; Field, 2009). The Bartlett’s test of sphericity was highly significant ( $p < 0.001$ ), which confirms that the correlation matrix is an identity matrix (Hair et al., 2010). Taken together, it was possible to confirm that the collected dataset was appropriate for factor analysis (see Appendix C.3, p. 233).

Looking into the total variance explained, the first three factors showed eigenvalues above 1.00. The scree plot also showed that the eigenvalues in the first three columns were above 1.00, and the line was almost flat after the fourth column. Given the eigenvalues and the scree plot, the 16 items were classified into the same three factors with the categories presented in Table 7.1 (see Appendix C.3, p. 233). This confirms the factor analysis results described in Section 4.2.1.

Cronbach’s alpha value was determined to confirm the factors’ reliability coefficient, which assesses the consistency of the entire scale. Values above 0.70 were considered significant (Hair et al., 2010). The Cronbach’s alpha values determined for each factor

were found to be above 0.70 (Privacy Awareness: 0.877, Trust/Carelessness: 0.914 and Responsibility: 0.785) (see Appendix C.3 for the complete results, p. 234).

### ***K-Means Cluster Analysis***

The result of the k-means cluster analysis was 35 in cluster 1, 78 in cluster 2, 50 in cluster 3 and 43 in cluster 4. The final cluster centres indicated that cluster 1 had very low values for “privacy awareness”, cluster 2 had very high values for “trust/carelessness” and “responsibility”, cluster 3 had very high values for “privacy awareness” and “responsibility” but very low values for “trust/carelessness”, and cluster 4 had very high values for “privacy awareness” but very low values for “responsibility” (Table 7.4).

[Table 7.4] Final cluster centres (*Note.* Very low values are in italic, average values in regular and very high values in bold.)

	<b>Cluster 1 (N = 35)</b>	<b>Cluster 2 (N = 78)</b>	<b>Cluster 3 (N = 50)</b>	<b>Cluster 4 (N = 43)</b>
<b>Privacy Awareness</b>	<i>-1.207</i>	-0.004	<b>0.751</b>	<b>1.171</b>
<b>Trust/Carelessness</b>	-0.421	<b>0.923</b>	<i>-0.578</i>	-0.066
<b>Responsibility</b>	<i>-0.057</i>	<b>1.017</b>	<b>1.152</b>	<i>-0.762</i>

### ***User Typology Validation***

The hypothesis of the user typology validation was that the cluster analysis results of the different and larger samples with an identical measurement would be consistent with the original study. The final cluster centres presented in Table 7.4 were not numerically identical to those presented in Table 4.5, which often occurs in replication experiments particularly in psychological studies (Belding, 2000; Schooler, 2014). However, it was possible to compare the final cluster centres in terms whether the values were very low, average or very high, which is referred to as “distributional equivalence” (Axelrod, 1997; Rand and Wilensky, 2006). Table 7.5 presents the comparison of the final cluster centres between the two different studies.

[Table 7.5] Comparison of final cluster centres (*Note.* Very low values are in italic, average values in regular and very high values in bold.)

	<b>Uninformed</b>	<b>Trustful</b>	<b>Suspicious</b>	<b>Neglectful</b>
<b>Privacy Awareness</b>	<i>-1.423</i> → <i>-1.207</i>	0.075 → -0.004	<b>0.576</b> → <b>0.751</b>	<b>0.843</b> → <b>1.171</b>
<b>Trust/Carelessness</b>	-0.240 → -0.421	<b>1.321</b> → <b>0.923</b>	<i>-1.149</i> → <i>-0.578</i>	-0.183 → -0.066
<b>Responsibility</b>	-0.451 → -0.057	<b>0.934</b> → <b>1.017</b>	<b>0.799</b> → <b>1.152</b>	<i>-1.310</i> → <i>-0.762</i>

- **Uninformed:** “Privacy awareness” was very low, and “trust/carelessness” and “responsibility” were average in both studies.
- **Trustful:** “Privacy awareness” was average, and “trust/carelessness” and “responsibility” were very high in both studies.
- **Suspicious:** “Privacy awareness” and “responsibility” were very high, and “trust/carelessness” was very low in both studies.
- **Neglectful:** “Privacy awareness” was very high, “trust/carelessness” was average, and “responsibility” was very low in both studies.

As a result, it was possible to confirm that the replicated study achieved the distributional equivalence. The hypothesis of the user typology validation was thus supported by the replicated results.

## 7.2.2 Persona Models Validation: Key Emotional Responses

### *Situation 1: Inadvertent Disclosure of Personal Information*

The key emotional responses in the first situation were disappointment, fear, hate and anger. The results of the Wilcoxon signed-rank test with the key emotional responses revealed that all the value differences were statistically significant at the 0.05 level (Table 7.6).

[Table 7.6] Summary of Wilcoxon signed-rank test in situation 1 (*Note.* Z values based on positive ranks)

	Uninformed (After-Before)		Trustful (After-Before)		Suspicious (After-Before)		Neglectful (After-Before)	
	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)
<b>Disappointment</b>	-4.033	<b>0.000</b>	-5.362	<b>0.000</b>	-4.072	<b>0.000</b>	-4.913	<b>0.000</b>
<b>Fear</b>					-3.764	<b>0.000</b>		
<b>Hate</b>	-2.559	<b>0.011</b>			-3.611	<b>0.000</b>	-4.171	<b>0.000</b>
<b>Anger</b>	-3.992	<b>0.000</b>			-4.175	<b>0.000</b>		

All the Z values, referring to the value of influences (Green and Salkind, 2012), were based on “positive” ranks, which means that all the values were smaller after intervention. Therefore, it was possible to determine that the negative key emotional responses decreased after the intervention of the software agent prototypes in the first situation.

### *Situation 2: Damaged Reputation Due to Rumours/Gossip*

The key emotional responses in the second situation were sadness, guilt, regret, shame, disappointment, disgust, hate and anger. The results of the Wilcoxon signed-rank test with

the key emotional responses revealed that all the value differences were statistically significant at the 0.05 level (Table 7.7).

[Table 7.7] Summary of Wilcoxon signed-rank test in situation 2 (*Note.* Z values based on positive ranks)

	Uninformed (After-Before)		Trustful (After-Before)		Suspicious (After-Before)		Neglectful (After-Before)	
	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)
<b>Sadness</b>					-4.314	<b>0.000</b>		
<b>Guilt</b>					-2.921	<b>0.003</b>		
<b>Regret</b>	-3.347	<b>0.001</b>			-4.003	<b>0.000</b>	-4.643	<b>0.000</b>
<b>Shame</b>	-3.764	<b>0.000</b>	-4.778	<b>0.000</b>	-4.205	<b>0.000</b>	-4.812	<b>0.000</b>
<b>Disappointment</b>	-2.804	<b>0.005</b>			-4.723	<b>0.000</b>	-4.438	<b>0.000</b>
<b>Disgust</b>	-2.775	<b>0.006</b>			-3.703	<b>0.000</b>		
<b>Hate</b>	-2.180	<b>0.029</b>			-3.308	<b>0.001</b>	-4.302	<b>0.000</b>
<b>Anger</b>	-2.924	<b>0.003</b>			-4.617	<b>0.000</b>		

All the Z values were based on “positive” ranks, which means that all the values were smaller after intervention. Therefore, it was possible to determine that the negative key emotional responses decreased after the intervention of the software agent prototypes in the second situation.

### ***Situation 3: Unwanted Contact and Harassment/Stalking***

The key emotional responses in the third situation were disappointment, hate and anger. The results of the Wilcoxon signed-rank test with the key emotional responses revealed that all the value differences were statistically significant at the 0.05 level (Table 7.8).

[Table 7.8] Summary of Wilcoxon signed-rank test in situation 3 (*Note.* Z values based on positive ranks)

	Uninformed (After-Before)		Trustful (After-Before)		Suspicious (After-Before)		Neglectful (After-Before)	
	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)
<b>Disappointment</b>	-3.407	<b>0.001</b>						
<b>Hate</b>	-3.877	<b>0.000</b>	-5.655	<b>0.000</b>	-4.521	<b>0.000</b>	-4.972	<b>0.000</b>
<b>Anger</b>	-4.114	<b>0.000</b>						

All the Z values were based on “positive” ranks, which means that all the values were smaller after intervention. Therefore, it was possible to determine that the negative key emotional responses decreased after the intervention of the software agent prototypes in the third situation.

**Situation 4: Surveillance-like Structure**

The key emotional response in the fourth situation was a positive one, interest, in the original study. Unlike the other situations, it was therefore evaluated whether interest increased in the user types from which interest did not emerge in the original study. The results of the Wilcoxon signed-rank test with interest revealed that the value differences were statistically significant at the 0.05 level (Table 7.9).

[Table 7.9] Summary of Wilcoxon signed-rank test in situation 4 (*Note.* Z values based on negative ranks)

	Uninformed (After-Before)		Suspicious (After-Before)	
	Z	Asymp. Sig. (2-tailed)	Z	Asymp. Sig. (2-tailed)
<b>Interest</b>	-2.553	<b>0.011</b>	-2.545	<b>0.011</b>

All the Z values were based on “negative” ranks, which means that all the values were greater after intervention. Therefore, it was possible to determine that the positive key emotional response increased after the intervention of the software agent prototypes in the fourth situation.

**Persona Models Validation**

The hypothesis of the persona models validation was that the negative key emotional responses in situations 1, 2 and 3 would decrease and the positive key emotional responses in situation 4 would increase after participants experienced the persona model-based software agent prototypes. The statistical analyses revealed the following:

- **Situation 1:** Negative key emotional responses identified in the original study — disappointment, fear, hate and anger — decreased significantly after the participants experienced the persona model-based software agent prototypes.
- **Situation 2:** Negative key emotional responses identified in the original study — sadness, guilt, regret, shame, disappointment, disgust, hate and anger — decreased significantly after the participants experienced the persona model-based software agent prototypes.
- **Situation 3:** Negative key emotional responses identified in the original study — disappointment, hate and anger — decreased significantly after the participants experienced the persona model-based software agent prototypes.



- **Situation 4:** Positive key emotional response identified in the original study — interest — increased significantly after the participants experienced the persona model-based software agent prototypes.

As a result, it was possible to confirm that the hypothesis of the persona model validation was supported by identifying the changes of key emotional responses after the intervention of the software agent prototypes.

### 7.3 Summary

This chapter validated the research outcomes — the proposed social network service user typology and persona models — through a quantitative approach. Based on the proposed persona models, software agent prototypes were developed for the validation study, which was conducted in two steps: (1) validating the user typology proposed in Chapter 4 by replicating user classification and (2) validating the persona models proposed in Chapter 6 by identifying the changes in key emotional responses after the intervention of the software agent prototypes. The research hypotheses for each step were the following:

1. The cluster analysis results of different and larger samples with the identical measurement approach would be consistent with the original study.
2. The negative key emotional responses in situations 1, 2 and 3 would decrease, and the positive key emotional responses in situation 4 would increase after participants experience the prototypes.

The research hypotheses were supported by statistical analyses. The study described in this chapter therefore validated the proposed social network service user typology and persona models.

# Chapter 8. Conclusions

## 8.1 Summary of Research

The studies described in Chapters 3 to 7 were performed to answer the research questions and to propose persona models for software agent development that would address privacy issues in social network services based on the analysis of users' emotional and behavioural responses. This chapter summarises the main findings of the studies and attempts to provide answers to the research questions formulated in Chapter 1.

### ***What are the opinions of the stakeholders regarding the current situation and the expected future of the social network service environment?***

The main goal of Chapter 3 was to identify the main considerations for the design of software agents in social network services in the near future by comprehending stakeholders' perspectives on the social network service environment. Twenty-one stakeholders, belonging to three key stakeholder groups, were recruited by a purposive sampling strategy for unstandardised semi-structured email interviews.

Three main considerations for the design of software agents in social network services emerged from the collected data, which were classified into the following categories: comprehensive understanding of users' perceptions of privacy; user type recognition algorithm for software agent development; and existing software agent enhancement. As a result, three theoretical propositions were identified based on the qualitative content analysis approach:

1. Detailed and comprehensive understanding of users' perceptions of privacy would be beneficial to implement rigorous privacy policy.
2. Implementation of a user type recognition algorithm for software agent development would be beneficial to understand social network service users' perceptions of privacy and to provide them with customised services.
3. Enhancement of existing software agents in terms of privacy protection would be beneficial in the saturated social network service market.

Synthesising the above propositions, the answer to the research question is suggested as follows:

*Prospective users of social network services would need an enhanced software agent in terms of privacy protection. To achieve this, it is important to have an in-depth*

*understanding of the variations in the personal perceptions of privacy that occur for the different user categories.*

***What are the main differences of the key emotional and behavioural responses between users in identical privacy infringement situations?***

The main goals of Chapters 4 and 5 were to explore how social network service users can be classified into meaningful categories by their perceptions of privacy and how each user group differently responds in terms of emotion and behaviour in identical situations of privacy infringement through a user-oriented experiment in a Facebook case study.

Fifty participants were recruited by a purposive sampling strategy for the experiment which included three research strategies: (1) perceptions of privacy questionnaire for user typology, (2) emotional response measurement using Geneva Emotion Wheel and (3) behavioural response observation using a contextual inquiry method.

As a result, the participants were classified into four distinct user types by cluster analysis — uninformed, trustful, suspicious and neglectful — to reflect different levels of privacy awareness, trust/carelessness and responsibility. By revealing the distinct characteristics of the four user types, the differences in perceptions of privacy and the new typology's theoretical implications compared with the previous user typology models were suggested. Each user type's key emotional and behavioural responses were also identified using statistical analysis methods and affinity diagrams respectively in privacy infringement situations. The answers to the research question are therefore suggested as follows:

- **Situation 1 (Inadvertent Disclosure of Personal Information):** In the first scenario for the experiment, one of the participant's friends disclosed the participant's bank account details publicly. Participants' key emotional responses were disappointment, fear, hate and anger. Disappointment emerged from all user types. Notable behavioural responses were that (1) "trustful" and "suspicious" participants grasped the situation very readily, (2) all user types deleted the disclosed information immediately, (3) "suspicious" and "uninformed" participants stressed that they would directly make a phone call, send a SMS or email to prevent further risks, (4) "suspicious" participants checked for further damage due to the disclosure and (5) "trustful" and "suspicious" participants took precautions against further threats.
- **Situation 2 (Damaged Reputation Due to Rumours/Gossip):** In the second scenario, the participant's reputation might be damaged due to some humiliating photos being posted online. Participants' key emotional responses were sadness, guilt, regret, shame, disappointment, disgust, hate and anger. Shame emerged from all user types. Notable behavioural responses were that (1) "trustful" and

“suspicious” participants grasped the situation very actively, (2) all user types removed the tags from the photos, (3) “suspicious” and “uninformed” participants removed tags from all photos, whereas the other two user types removed tags only from selected photos, (4) “suspicious” and “uninformed” participants said that they would directly make a phone call and (5) “trustful” and “suspicious” participants took precautions against further threats.

- **Situation 3 (Unwanted Contact and Harassment/Stalking):** In the third scenario, participants received regular spam messages. Participants’ key emotional responses were disappointment, hate and anger. Hate emerged from all user types. Notable behavioural responses were that (1) the vast majority of participants simply concluded that the message was spam and did not even try to read the message, (2) “uninformed” participants checked the other party’s profile, deleted the message, blocked the sender and reported to the service immediately, (3) “suspicious” and “neglectful” participants said that they would block the sender if the action were repeated and (4) “trustful” and “suspicious” participants took precautions against further threats.
- **Situation 4 (Surveillance-like Structure):** In the fourth scenario, participants received a friend request from a stranger. The key emotion was a positive one: interest. The majority of participants might take an interest or pay no attention to such a request. Notable behavioural responses were that (1) the vast majority of participants checked mutual friends, (2) “trustful” and “neglectful” participants looked over the other party’s profile, activities and photos very closely, (3) “uninformed” participants declined the request and (4) “trustful” and “suspicious” participants took precautions against further threats.

### ***How can the analysis of users’ emotional and behavioural responses contribute to designing a software agent to address the privacy issues?***

The main goal of Chapter 6 was to develop persona models of each user type by synthesising the identified information in the Facebook case study described in Chapters 4 and 5, and by identifying correlations between users’ perceptions of privacy, key emotional responses and key behavioural responses. The persona models of each user type included the name of the user type and its perceptions of privacy, key emotional responses of the corresponding user type and workflows of key behavioural responses by situation.

By integrating the results of the case study, it was possible to identify likely connections between perceptions of privacy, key emotional responses and key behavioural responses reflected in the persona models and to suggest two fundamental features of the software agent — confirmation and guidance — that would benefit users in terms of their privacy

protection and would maintain the stability of the service. The answers to the research question are therefore suggested as follows:

- **Confirmation:** Software agent's autonomous and reactive activities that focus on data-mining of related information and confirming users' decisions within privacy infringement situations to save users' effort of repeating the key behavioural responses whenever the privacy infringement situations occur.
- **Guidance:** Software agent's activities that focus on encouraging users to engage in the procedures that were not dominant in the corresponding user type to educate those unaware of privacy practices and to encourage those unable to protect their own personal information.

Finally, the proposed social network service user typology and persona models were validated through a quantitative approach in Chapter 7. Based on the proposed persona models, software agent prototypes were developed for the validation study, which was conducted in two steps: (1) validating the user typology proposed in Chapter 4 by replicating user classification and (2) validating the persona models proposed in Chapter 6 by identifying the changes in key emotional responses after the intervention of the software agent prototypes. The research hypotheses for each step were the following:

1. The cluster analysis results of different and larger samples with the identical measurement approach would be consistent with the original study.
2. The negative key emotional responses in situations 1, 2 and 3 would decrease, and the positive key emotional responses in situation 4 would increase after participants experience the prototypes.

The research hypotheses were supported by statistical analyses. The study described in this chapter therefore validated the proposed social network service user typology and persona models.

### **Concluding Remarks**

The research described in this thesis aimed *to propose persona models for software agent development that contribute to addressing privacy issues in social network services based on the analysis of users' emotional and behavioural responses*. To achieve the aim, the research (1) proposed a social network service user typology based on users' perceptions of privacy, (2) analysed the differences among the classified user groups in terms of their emotional and behavioural responses in identical privacy infringement situations and (3) created persona models of each user type by synthesising the findings. These persona models are expected to help software agent designers/developers to better understand

users' perspectives towards privacy issues in social network services. The fundamental tasks of the software agent were proposed as follows:

1. To recognise the type of users based on their behaviour patterns;
2. To detect privacy infringement situations by running in the background;
3. To provide users with appropriate “confirmation” and “guidance” items based on their user types.

The four essential characteristics of a software agent — autonomous, reactive, goal-oriented and temporally continuous — should be prerequisites to successfully perform these tasks. The basic workflow of the software agent from the interface design perspective was proposed as follows:

1. Privacy notification icon on the upper-right corner shows a red exclamation mark if there is any privacy infringement situation on the user's account.
2. If the user clicks the privacy notification icon, privacy notification popup is shown with a brief description of the situation. The popup includes two buttons: “not now” and “go”.
3. If the user clicks the “go” button, the user is directed to the corresponding privacy infringement situation. The problematic situation is highlighted and the software agent shows detailed “confirmation” and “guidance” items based on the user type.

The “confirmation” mode of the software agent is expected to save users' effort of repeating the key behavioural responses whenever the privacy infringement situations occur. On the other hand, the “guidance” mode is expected to educate those who lack awareness of privacy practices and to encourage those who lack the motivation or responsibility to protect their own personal information. Therefore, by implementing the research outcomes, the software agent described in this thesis would be able to provide users with appropriate services based on their user types, to reduce the number of those who are still unaware of privacy practice and those who neglect their accounts, and to expand the size of a user group pursuing sound relationships.

## 8.2 Research Contributions

The research described in this thesis makes contributions by covering multiple facets such as theory, practice and methodology.

### ***Theoretical Contributions***

This research proposed a theoretical model of social network service user types based on users' perceptions of privacy (see Chapter 4). Although there have been efforts to classify social network service users into categories, they have often been based on users' behaviour within the services. This research indicated that it could be novel and beneficial in terms of privacy protection if tailored services were offered to the classified user types based on their perceptions of privacy. By revealing the distinct characteristics of the four user types, the differences in perceptions of privacy were suggested followed by the new typology's theoretical implications compared to the previous user typology models.

### ***Practical Contributions***

This research proposed a practical approach to analysing social network service users' emotional and behavioural responses in specific privacy infringement situations (see Chapter 5). As mentioned in Section 1.1.3, the majority of studies on privacy issues in social network services merely warned of the potential risks or suggested safeguards against possible threats and risks. In other words, relatively few studies have proposed possible solutions based on users' instant responses. Given that the field data (i.e., users' instant responses) can play a crucial role in overcoming the difficulties of discovering insightful tacit information, this research particularly employed a human centred design approach. The assumption was that it would be beneficial for designers/developers to empathise with users if they had in-depth understanding of users' emotional and behavioural responses.

This research also proposed persona models as a practical design solution by integrating the proposed social network service user typology based on the perceptions of privacy and an analysis of each user type's emotional and behavioural responses in specific privacy infringement situations (see Chapter 6). The proposed persona models are expected to enhance software agents in terms of privacy protection by suggesting two fundamental features — confirmation and guidance — that could benefit users in terms of their privacy protection and, in a sense, maintain the stability of the social network services.

### ***Methodological Contributions***

Relatively few studies have proposed possible solutions to privacy issues based on users' instant responses in social network services. Given the human centred design paradigm from the viewpoints of branding and business strategy, employing the human centred design approach was considered a possible and progressive method to fill the research gap. In Chapters 4 to 6, the main outcomes of this research, persona models, were developed

through a Facebook case study that investigated actual users' perceptions of privacy, emotional responses and behavioural responses. The research methods employed for data collection were questionnaire, emotion measurement and contextual inquiry. Methods used for data analysis were clustering analysis, Kruskal-Wallis test, Mann-Whitney  $U$  test and affinity diagram. These methods were considered promising for identifying answers to the research questions formulated in the introduction of the research. The research process and methodological insights of this research could be incorporated into future empirical research on users' privacy concerns, user typology, emotional responses or behavioural responses.

### 8.3 Limitations and Further Research

The research described in this thesis has several limitations. Based on the limitations of the research, directions for further research are suggested as follows.

#### ***Sample Size***

There were 21 participants in Chapter 3. Given that the study described in Chapter 3 was a qualitative interview research, a larger sample size might not be appropriate. However, seven participants in each group may be considered an insufficient size, as the participants were divided into three stakeholder groups. In the case study described in Chapters 4 and 5, the number of participants was 50. Although this was not a small sample size for a qualitative study, 12 to 13 participants in each user type (four user types in total) might also be considered an insufficient size for a quantitative statistical analysis; thus, a non-parametric test was conducted. In the validation study described in Chapter 7, the number of participants was 206. Although this was a sufficient size for a quantitative analysis, a non-parametric test was conducted to analyse data by user type. The research described in this thesis yielded significant results despite these limitations. However, more rigorous and significant results would be expected with a larger sample size in either qualitative or quantitative studies. Particularly in the quantitative study, if the dataset satisfied the assumptions for a parametric test, such as normal distribution of dataset and homogeneity of variance, more reliable results would be expected.

#### ***The Number of Cases***

The case study described in Chapters 4 and 5 employed a single case (i.e., Facebook). This context was considered appropriate as the criteria for choosing it included some extreme requirements such as the largest service and a higher risk of privacy infringement among possible services. The results from the case study in this research would be significant as



Facebook has the most active users worldwide; thus, Facebook situations would be highly generalisable. However, there could be some situations that might occur in other services but not in Facebook. Therefore, a comparative study of users' emotional and behavioural responses in different social network services would be interesting and also meaningful. Furthermore, multiple cases would also yield more reliable results in terms of generalisation.

### ***Fake Social Network Service Profiles for Experiment***

Fake Facebook profiles were used in the case study described in Chapter 5. As mentioned, the most critical potential limitation of using the fake profiles was that the participants' emotional and behavioural responses might not be fully empathised with the situations. Nevertheless, fake profiles were used because it was not guaranteed that all the privacy infringement situations would occur during the experiment sessions with actual profiles. To overcome this limitation, a longitudinal ethnography study for a sufficient period of time could be a possible solution to identify real privacy infringement situations and to investigate how users deal with those situations, rather than investigating with fake profiles within artificial scenarios.

### ***The Number of Privacy Infringement Situations***

Four privacy infringement situations were used for the experiment in Chapter 5 and the validation study in Chapter 7. As explained in Section 5.1.6, there are numerous privacy infringement situations in the real world. However, the study could not deal with every possible privacy infringement situation in Facebook. A pilot study was therefore conducted to narrow down to the achievable number of situations. A longitudinal study, dealing with situations that were omitted in this research, would enable more holistic and profound conclusions to be drawn.

### ***Emotion Measurement Tool***

The studies described in Chapters 5 and 7 used a self-assessment technique, the Geneva Emotion Wheel (GEW), to measure participants' emotional responses. This technique is useful because people know their own emotions best. However, imperceptible emotions could be overlooked occasionally. In a similar way, design researchers often observe user behaviour, rather than ask them what their needs are, in order to find hidden needs. The imperceptible emotional responses that participants may overlook when self-assessing during the experiment could be accurately assessed by facial expression recognition software, overcoming sole reliance on emotion self-assessment.

### ***Prototyping***

The validation study described in Chapter 7 used the prototype images of software agents representing the proposed persona models and the main interface designs of software agents. The prototype images used for the study accurately illustrated the persona models, and the study statistically validated the proposed persona models. However, participants were not able to experience the software agent prototypes in terms of the holistic user experience such as moving the mouse, clicking it and interacting with the prototypes. Therefore, more reliable results might be obtained by developing working prototypes to validate the new ideas. For example, prototyping tools such as Axure, InVision and UXPin, which are widely used in the design and user experience fields, would be possible solutions.

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# Appendix A. Define

## A.1 Interview Questions

### ***Business Stakeholder***

#### **Profile**

1. Could you please briefly describe your career such as your current position, major responsibilities and your overall work experience?

#### **Main Stakeholders in Social Network Service Sector**

2. In your opinion, who do you feel are the main stakeholders with whom you are connected?
3. What is the nature of the relationships with the stakeholders?

#### **Examples of Software Agents in Social Network Services**

4. In your opinion, what do you think are good examples of software agents in social network services? Please give me some examples.
5. Why do you think are they good examples?

#### **Business Strategy**

6. If possible, could you please talk about any project in which you were/are involved related to the software agents design or development in social network services?
7. What was/is your main strategy for the design or development?

#### **Key Issues in Social Network Services**

8. What kind of issues did/do you face? When and why do you think have they occurred?
9. How did/do you deal with the issues?
10. How do you take the difference of user types into consideration when designing or developing software agents in social network services?

#### **Expected Future of the Internet and Social Network Services**

11. In your opinion, how do you think the internet and social network service trends are going to be changed in the near future?

## **Government Stakeholder**

### **Profile**

1. Could you please briefly describe your career such as your current position, major responsibilities and your overall work experience?

### **Main Stakeholders in Social Network Service Sector**

2. In your opinion, who do you feel are the main stakeholders with whom you are connected?
3. What is the nature of the relationships with the stakeholders?

### **Examples of Software Agents in Social Network Services**

4. In your opinion, what do you think are good examples of software agents in social network services? Please give me some examples.
5. Why do you think are they good examples?

### **Government Strategy**

6. If possible, could you please talk about any project in which you were/are involved related to making, implementing or managing regulation/policy of software agents in social network services?
7. What was/is your main strategy for the policy making, implementation or management?

### **Key Issues in Social Network Services**

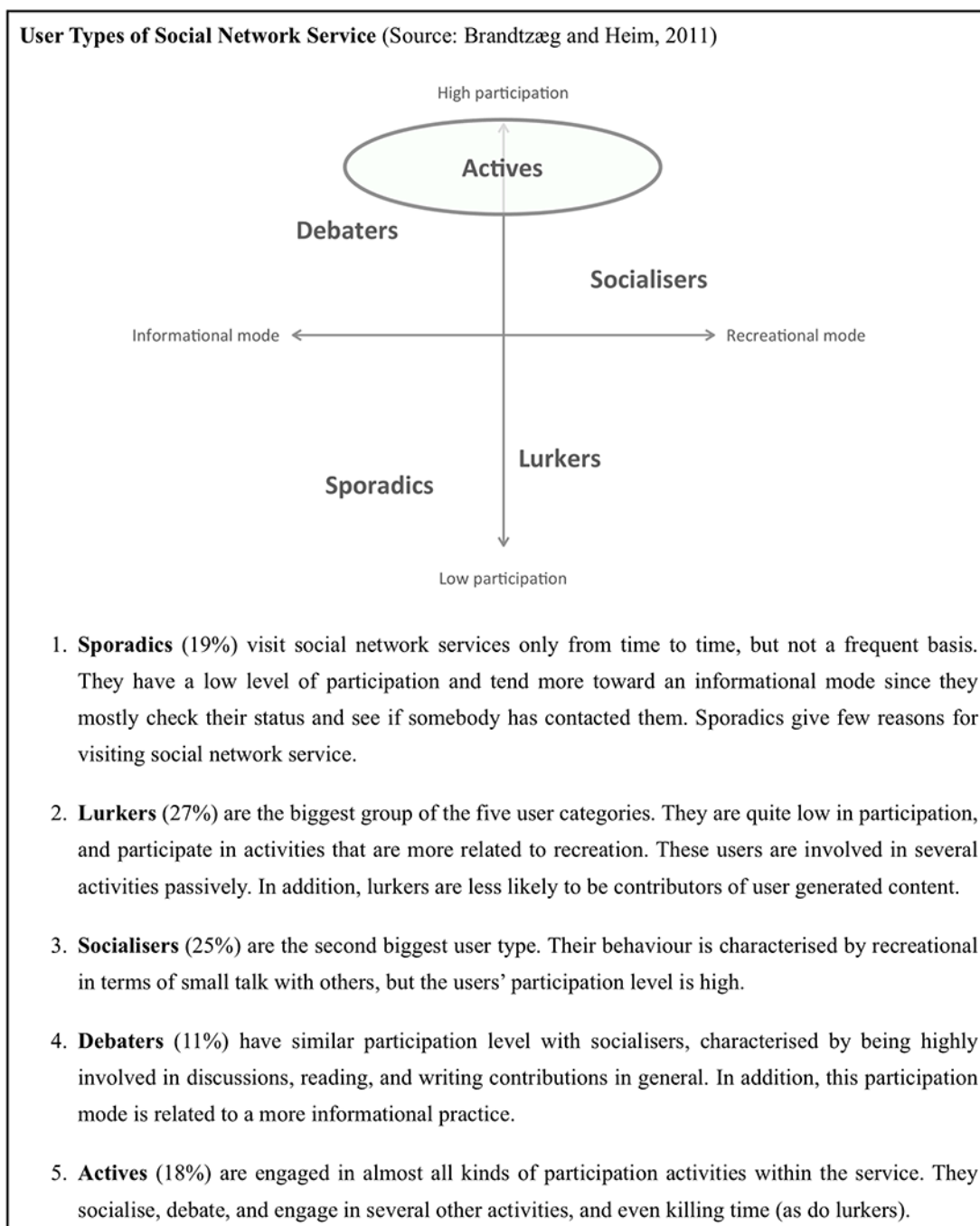
8. What kind of issues did/do you face? When and why do you think have they occurred?
9. How did/do you deal with the issues?
10. How do you take the difference of user types into consideration when making, implementing or managing regulation/policy of software agents in social network services?

### **Expected Future of the Internet and Social Network Services**

11. In your opinion, how do you think the internet and social network service trends are going to be changed in the near future?

## Consumer Stakeholder

### Profile



1. Could you please briefly describe yourself? For example, how many years have you used social network services? How many profiles do you manage? What are your main activities in such services?
2. To which group do you feel you belong among the five user types above in social network services?

### **Main Stakeholders in Social Network Service Sector**

3. In your opinion, who do you feel are the main stakeholders with whom you are connected?
4. What is the nature of the relationships with the stakeholders?

### **Examples of Software Agents in Social Network Services**

5. In your opinion, what do you think are good examples of software agents in social network services? Please give me some examples.
6. Why do you think are they good examples?

### **Customer Experience**

7. Could you please talk about any experience of yours related to the software agents in social network services?

### **Key Issues in Social Network Services**

8. What kind of issues did/do you face? When and why do you think have they occurred?
9. How did/do you deal with the issues?
10. At the beginning, you classified yourself as the \_\_\_\_\_ type. Could you please describe your experience if there were customised services when using software agents in social network services?

### **Expected Future of the Internet and Social Network Services**

11. In your opinion, how do you think the internet and social network service trends are going to be changed in the near future?

## A.2 Interview Participants Profiles

### *Business Stakeholder*

Market research / Brand	
<b>Current</b>	A market researcher and global sales strategist at a global social media company in the USA
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Qualitative and quantitative research and insight mining</li> <li>• Business development</li> <li>• Turning large amounts of data into ‘golden nugget’ insights</li> </ul>
<b>Experience</b>	16 years
Marketing	
<b>Current</b>	A product marketing manager at a global social media company in the USA
<b>Responsibility</b>	Creating global marketing programmes such as online strategy, industry relations, partner/agency marketing, internal marketing, and content & go-to-market strategy
<b>Experience</b>	10 years
Product	
<b>Current</b>	A software developer at an Internet content service operator in Korea
<b>Responsibility</b>	Software development duties for company’s social network service in Korea and Japan
<b>Experience</b>	12 years
Sales	
<b>Current</b>	A sales expert at a global social media company in the USA
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Guiding advertiser relationships with a focus on driving mutual revenue, platform education &amp; client satisfaction</li> <li>• Serving as an industry leader in social media and digital advertising, and adapting to company’s ongoing product and technology developments</li> <li>• Creating and delivering consultive sales presentations using industry knowledge, market trends and marketing solutions</li> </ul>
<b>Experience</b>	14 years

<b>Customer care</b>	
<b>Current</b>	A customer success manager at a software corporation in the USA
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Consultatively working with customers to discover and define use cases and vision for success</li> <li>• Understanding customer concerns and requests while digging deep to provide valuable feedback to the product team</li> </ul>
<b>Experience</b>	7 years

<b>PR / Corporate communication</b>	
<b>Current</b>	A public policy expert at a global social media company in the USA
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Conducting legislative research</li> <li>• Drafting policy memos on the issues pertaining to the company's business interests</li> </ul>
<b>Experience</b>	5 years

<b>Editors / Bloggers</b>	
<b>Current</b>	A blogger in social media, and also an individual consultant in social media strategy in Korea
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Dealing with the latest news and issues of social media (especially business model, strategy, users' needs, etc.)</li> <li>• Suggesting and proposing new business strategies based on the clients' request</li> </ul>
<b>Experience</b>	6 years

### **Government Stakeholder**

<b>Intergovernmental and international organisation 1</b>	
<b>Current</b>	A data protection officer at an intergovernmental organisation in Belgium
<b>Responsibility</b>	Analysing the characteristics and usability of social network services for possible implementation within the European market
<b>Experience</b>	12 years

<b>Intergovernmental and international organisation 2</b>	
<b>Current</b>	A security expert and information security officer at an intergovernmental organisation in Greece
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Leading projects for the implementation of the EU-wide security legislation</li> <li>• Drafting organisation's internal information security policies and procedures</li> <li>• Reviewing the implementation of security measures and the overall security posture</li> </ul>
<b>Experience</b>	11 years
<b>Government</b>	
<b>Current</b>	A communications policy adviser and IP legal adviser at a communications regulator in the UK
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Drafting and handling basic documentation for law cases in the sphere of social media</li> <li>• Conducting research on the registrability of IP rights and preparing reports on the results</li> </ul>
<b>Experience</b>	7 years
<b>Private sector</b>	
<b>Current</b>	An independent research consultant on the topics of Internet law, open licensing and IP in Costa Rica
<b>Responsibility</b>	Producing international, legal research in the areas of open source, open licensing, e-commerce, information technology law, copyright enforcement, cybercrime, telecommunications, Internet law, virtual worlds, and others
<b>Experience</b>	10 years
<b>Civil society</b>	
<b>Current</b>	An information security manager at a research oriented university in Korea
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Implementing information protection policy</li> <li>• Applying the information security solution to the network infrastructure</li> <li>• Monitoring information transaction within the institute</li> </ul>
<b>Experience</b>	6 years



Academic and technical community 1	
<b>Current</b>	A research associate at a research oriented university in the UK
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Developing an algorithm of mathematical modelling and effective calculation for sequential decision making</li> <li>• Optimising users' sequential decision making in order to make it correspondence with their goal through applying the reinforcement technique to the spoken dialogue system</li> </ul>
<b>Experience</b>	10 years

Academic and technical community 2	
<b>Current</b>	An academic researcher at a research oriented university in Korea
<b>Responsibility</b>	<ul style="list-style-type: none"> <li>• Research on the artificial intelligent algorithms for recommender systems that can be applied to social network services, online shopping sites, mail services or news services</li> <li>• Making algorithms natural, intelligent, efficient and compatible</li> </ul>
<b>Experience</b>	6 years

### **Consumer Stakeholder**

Sporadic	
<b>Nationality</b>	UK
<b>Usage</b>	10 years
<b>Accounts</b>	3 accounts (currently using LinkedIn only)
<b>Activities</b>	Managing his professional networks in one place

Lurker 1	
<b>Nationality</b>	Korea
<b>Usage</b>	7 years
<b>Accounts</b>	4 accounts: Facebook, KakaoStory and Cyworld
<b>Activities</b>	<ul style="list-style-type: none"> <li>• Facebook: Using the most to communicate with friends both in the USA and in Korea</li> <li>• KakaoStory and Cyworld: Occasionally staying in contact with friends in Korea</li> </ul>

<b>Lurker 2</b>	
<b>Nationality</b>	Korea
<b>Usage</b>	10 years
<b>Accounts</b>	3 accounts: Cyworld, Facebook and LinkedIn.
<b>Activities</b>	<ul style="list-style-type: none"> <li>• Cyworld: Contacting with her close friends</li> <li>• Facebook: Checking recent states of members in her groups</li> <li>• LinkedIn: Making new relationships with those who have similar expertise to her</li> </ul>
<b>Socialiser 1</b>	
<b>Nationality</b>	USA
<b>Usage</b>	6 years
<b>Accounts</b>	5 accounts: Facebook, Google+, Twitter, LinkedIn and Foursquare
<b>Activities</b>	Sharing ideas, articles and photos with her network through her wall or personal emails
<b>Socialiser 2</b>	
<b>Nationality</b>	UK
<b>Usage</b>	6 years
<b>Accounts</b>	2 accounts: Facebook and LinkedIn
<b>Activities</b>	Keeping in touch with friends and professional colleagues all over the world
<b>Debater</b>	
<b>Nationality</b>	Korea
<b>Usage</b>	6 years
<b>Accounts</b>	6 accounts: Facebook, Twitter, Google+, LinkedIn, Foursquare and Instagram
<b>Activities</b>	<ul style="list-style-type: none"> <li>• Facebook and Google+: Keeping in touch with friends</li> <li>• Twitter: Posting personal updates and sharing her thoughts</li> <li>• LinkedIn: Managing professional connections</li> <li>• Foursquare and Instagram: Using media to communicate with friends</li> </ul>

<b>Active</b>	
<b>Nationality</b>	USA
<b>Usage</b>	7 years
<b>Accounts</b>	5 accounts: Facebook, Twitter, LinkedIn, Yammer and Instagram
<b>Activities</b>	<ul style="list-style-type: none"><li>• Facebook: Keeping in touch with her friends</li><li>• Twitter: Reading others' updates</li><li>• LinkedIn: Looking for a job or hiring someone</li><li>• Yammer: Posting teamwork oriented status updates</li><li>• Instagram: Using photos to communicate with friends</li></ul>

# Appendix B. Develop

## B.1 User Typology

### B.1.1 Factor Analysis

KMO and Bartlett's Test

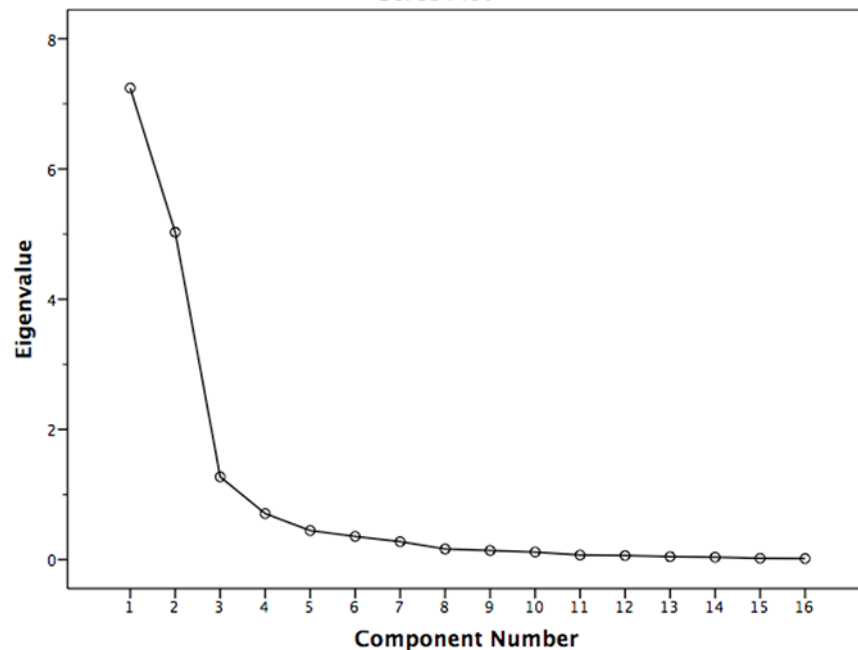
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.767
Bartlett's Test of Sphericity	Approx. Chi-Square	1090.454
	df	120
	Sig.	.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.244	45.272	45.272	7.244	45.272	45.272	4.922	30.761	30.761
2	5.029	31.428	76.700	5.029	31.428	76.700	4.332	27.075	57.836
3	1.271	7.946	84.646	1.271	7.946	84.646	4.290	26.810	84.646
4	.707	4.421	89.067						
5	.446	2.790	91.857						
6	.357	2.230	94.087						
7	.276	1.723	95.810						
8	.163	1.021	96.831						
9	.140	.877	97.708						
10	.116	.726	98.435						
11	.070	.439	98.874						
12	.062	.390	99.264						
13	.045	.284	99.548						
14	.037	.229	99.777						
15	.020	.124	99.901						
16	.016	.099	100.000						

Extraction Method: Principal Component Analysis.

Scree Plot



## B.1.2 Reliability Analysis

### *Privacy Awareness*

Item–Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Cronbach's Alpha if Item Deleted
PP1	19.7600	34.390	.818	.837
PP2	20.1400	31.225	.862	.833
PP3	20.2400	30.798	.935	.822
PP4	19.7400	38.686	.675	.835
PP5	19.2800	33.308	.862	.832
PP6_R	19.4400	34.129	.881	.830

Reliability Statistics

Cronbach's Alpha	N of Items
.845	6

### *Trust/Carelessness*

Item–Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Cronbach's Alpha if Item Deleted
PP7_R	13.0600	22.507	.707	.831
PP8	13.8000	21.184	.805	.818
PP9	13.2000	23.429	.823	.817
PP10	12.7000	20.745	.855	.811
PP11	14.0200	22.142	.817	.816
PP12	14.6200	24.485	.884	.816

Reliability Statistics

Cronbach's Alpha	N of Items
.831	6

### *Responsibility*

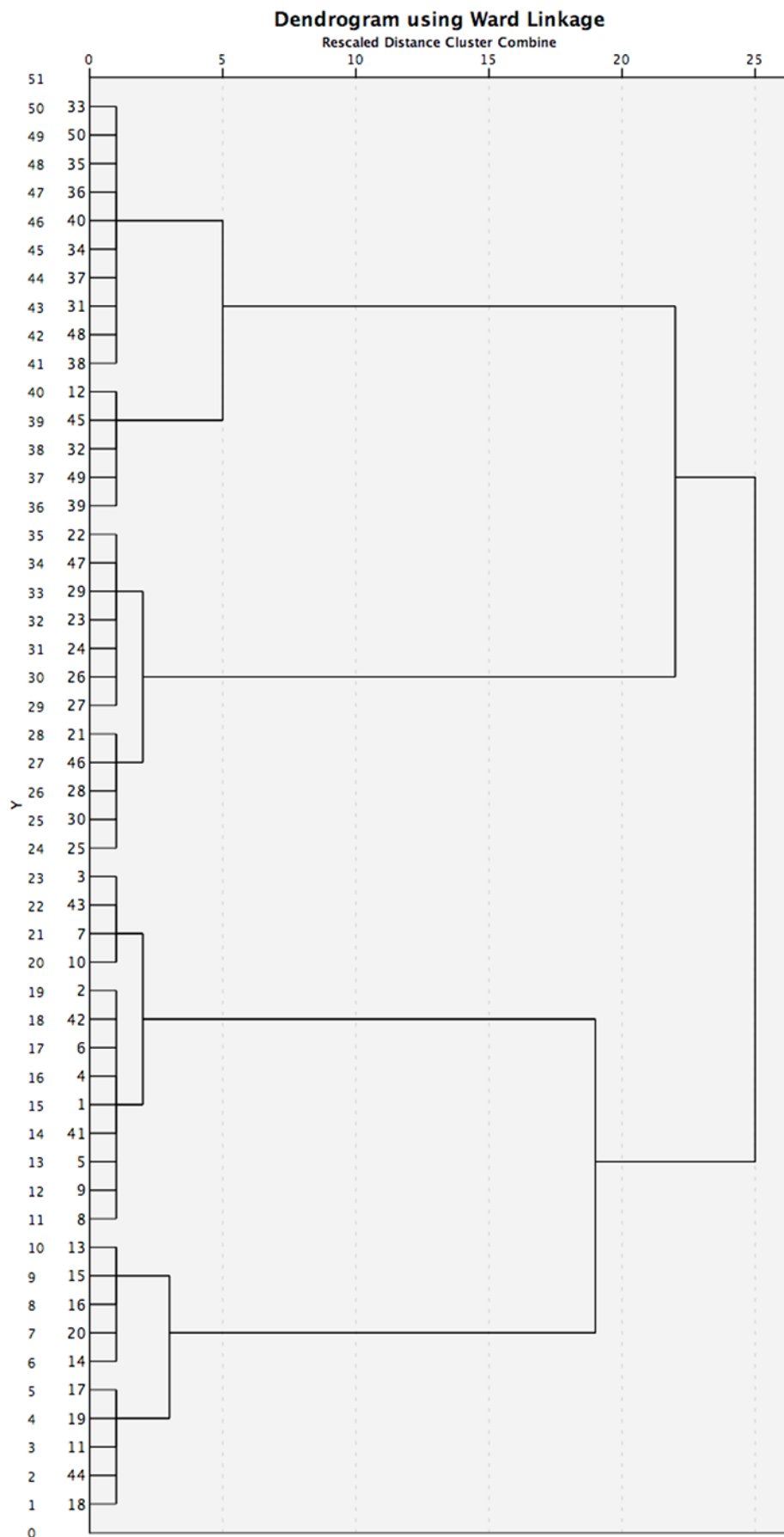
Item–Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Cronbach's Alpha if Item Deleted
PP13	12.0400	17.794	.855	.842
PP14	12.4600	15.192	.870	.836
PP15	11.7000	15.031	.901	.825
PP16_R	11.5000	16.092	.900	.825

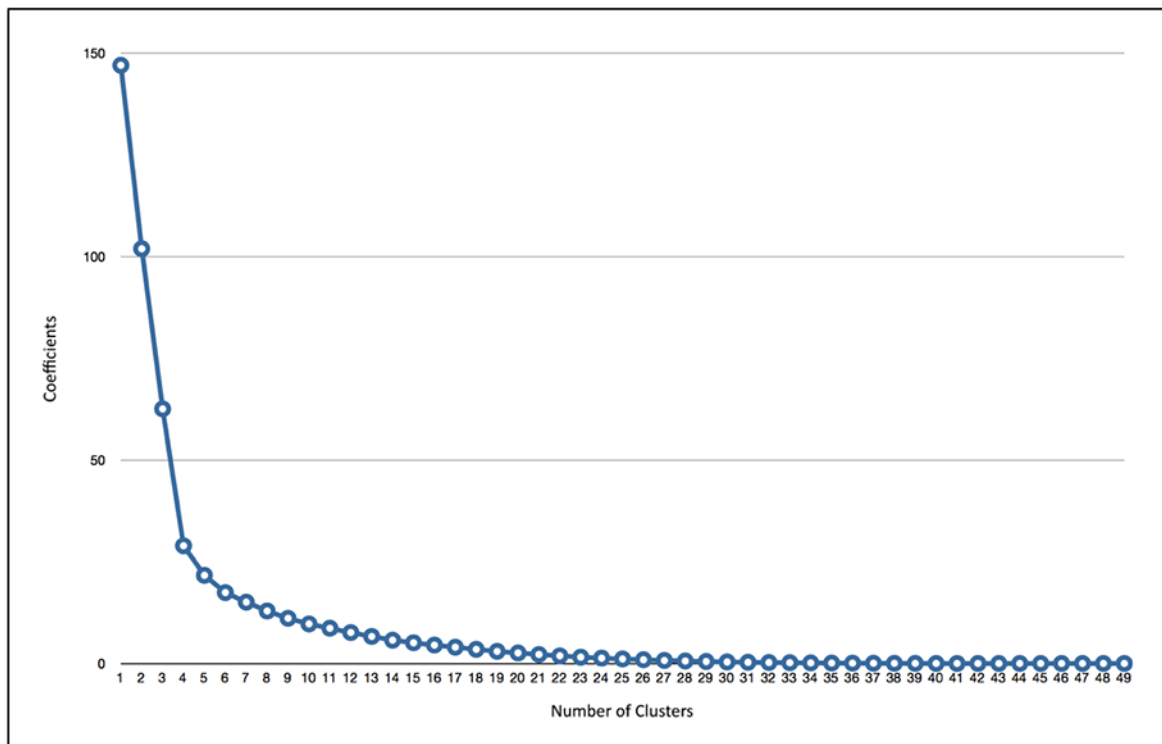
Reliability Statistics

Cronbach's Alpha	N of Items
.848	4

### B.1.3 Hierarchical Cluster Analysis



Scree Plot



### B.1.4 One-Way ANOVA & Multiple Comparisons

Tests of Normality

Cluster	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk			
	Statistic	df	Sig.	Statistic	df	Sig.	
Privacy Awareness	1	.183	13	.200 <sup>*</sup>	.896	13	.117
	2	.211	12	.147	.884	12	.100
	3	.214	13	.107	.884	13	.080
	4	.182	12	.200 <sup>*</sup>	.940	12	.494
Trust/Carelessness	1	.197	13	.177	.925	13	.293
	2	.234	12	.068	.869	12	.064
	3	.138	13	.200 <sup>*</sup>	.964	13	.818
	4	.226	12	.090	.886	12	.106
Responsibility	1	.217	13	.094	.871	13	.054
	2	.177	12	.200 <sup>*</sup>	.922	12	.302
	3	.146	13	.200 <sup>*</sup>	.936	13	.403
	4	.140	12	.200 <sup>*</sup>	.923	12	.310

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Privacy Awareness	1.546	3	46	.215
Trust/Carelessness	7.526	3	46	.000
Responsibility	4.828	3	46	.005

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Privacy Awareness	Between Groups	39.249	3	13.083	61.722	.000
	Within Groups	9.751	46	.212		
	Total	49.000	49			
Trust/Carelessness	Between Groups	39.255	3	13.085	61.768	.000
	Within Groups	9.745	46	.212		
	Total	49.000	49			
Responsibility	Between Groups	42.007	3	14.002	92.100	.000
	Within Groups	6.993	46	.152		
	Total	49.000	49			

Robust Tests of Equality of Means

		Statistic <sup>a</sup>	df1	df2	Sig.
Privacy Awareness	Welch	82.744	3	24.773	.000
Trust/Carelessness	Welch	121.883	3	24.236	.000
Responsibility	Welch	98.735	3	24.507	.000

a. Asymptotically F distributed.



Multiple Comparisons

Dependent Variable		(I) Cluster	(J) Cluster	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval		
							Lower Bound	Upper Bound	
Privacy Awareness	Scheffe	1	2	-1.497918*	.18430756	.000	-2.0327444	-.9630912	
			3	-1.999399*	.18058380	.000	-2.5234195	-1.4753777	
			4	-2.266553*	.18430756	.000	-2.8013794	-1.7317262	
			2	1.4979178*	.18430756	.000	.9630912	2.0327444	
		2	3	-.5014808*	.18430756	.044	-1.0363074	.0333458	
			4	-.7686350*	.18795757	.002	-1.3140532	-.2232167	
			3	1	1.9993986*	.18058380	.000	1.4753777	2.5234195
				2	.5014808*	.18430756	.044	-.0333458	1.0363074
		4	4	-.26715420	.18430756	.557	-.8019808	.2676724	
			1	2.2665528*	.18430756	.000	1.7317262	2.8013794	
			2	.76863497*	.18795757	.002	.2232167	1.3140532	
			3	.26715420	.18430756	.557	-.2676724	.8019808	
	Games-Howell	1	2	-1.497918*	.15880472	.000	-1.9428516	-1.0529840	
			3	-1.999399*	.17631112	.000	-2.4940100	-1.5047871	
			4	-2.266553*	.16746674	.000	-2.7377696	-1.7953359	
			2	1.4979178*	.15880472	.000	1.0529840	1.9428516	
		2	3	-.50148077	.20042630	.086	-1.0565635	.0536020	
			4	-.7686350*	.19269198	.003	-1.3039544	-.2333156	
			3	1	1.9993986*	.17631112	.000	1.5047871	2.4940100
				2	.50148077	.20042630	.086	-.0536020	1.0565635
		4	4	-.26715420	.20735687	.579	-.8410061	.3066977	
			1	2.2665528*	.16746674	.000	1.7953359	2.7377696	
			2	.76863497*	.19269198	.003	.2333156	1.3039544	
			3	.26715420	.20735687	.579	-.3066977	.8410061	
Trust/Carelessness	Scheffe	1	2	-1.561523*	.18425286	.000	-2.0961913	-1.0268556	
			3	.90846302*	.18053019	.000	.3845977	1.4323284	
			4	-.42320765	.18425286	.168	-.9578755	.1114602	
			2	1.5615235*	.18425286	.000	1.0268556	2.0961913	
		2	3	2.4699865*	.18425286	.000	1.9353186	3.0046543	
			4	1.1383158*	.18790178	.000	.5930595	1.6835722	
			3	1	-.9084630*	.18053019	.000	-1.4323284	-.3845977
				2	-2.469986*	.18425286	.000	-3.0046543	-1.9353186
		4	4	-1.331671*	.18425286	.000	-1.8663385	-.7970028	
			1	.42320765	.18425286	.168	-.1114602	.9578755	
			2	-1.138316*	.18790178	.000	-1.6835722	-.5930595	
			3	1.3316707*	.18425286	.000	.7970028	1.8663385	
	Games-Howell	1	2	-1.561523*	.16746566	.000	-2.0265374	-1.0965095	
			3	.90846302*	.15237475	.000	.4798854	1.3370407	
			4	-.42320765	.23142443	.290	-1.0709109	.2244956	
			2	1.5615235*	.16746566	.000	1.0965095	2.0265374	
		2	3	2.4699865*	.12666950	.000	2.1162863	2.8236866	
			4	1.1383158*	.21537030	.000	.5257015	1.7509302	
			3	1	-.9084630*	.15237475	.000	-1.3370407	-.4798854
				2	-2.469986*	.12666950	.000	-2.8236866	-2.1162863
		4	4	-1.331671*	.20385701	.000	-1.9222161	-.7411252	
			1	.42320765	.23142443	.290	-.2244956	1.0709109	
			2	-1.138316*	.21537030	.000	-1.7509302	-.5257015	
			3	1.3316707*	.20385701	.000	.7411252	1.9222161	
Responsibility	Scheffe	1	2	-1.384722*	.15609020	.000	-1.8376672	-.9317772	
			3	-1.250117*	.15293654	.000	-1.6939104	-.8063231	
			4	.85917229*	.15609020	.000	.4062273	1.3121173	
			2	1.3847222*	.15609020	.000	.9317772	1.8376672	
		2	3	.13460543	.15609020	.862	-.3183396	.5875504	
			4	2.2438945*	.15918140	.000	1.7819794	2.7058096	
			3	1	1.2501168*	.15293654	.000	.8063231	1.6939104
				2	-.13460543	.15609020	.862	-.5875504	.3183396
		4	4	2.1092891*	.15609020	.000	1.6563441	2.5622341	
			1	-.8591723*	.15609020	.000	-1.3121173	-.4062273	
			2	-2.243894*	.15918140	.000	-2.7058096	-1.7819794	
			3	-2.109289*	.15609020	.000	-2.5622341	-1.6563441	
	Games-Howell	1	2	-1.384722*	.09742324	.000	-1.6544423	-1.1150021	
			3	-1.250117*	.12953041	.000	-1.6128047	-.8874289	
			4	.85917229*	.18120833	.001	.3348272	1.3835174	
			2	1.3847222*	.09742324	.000	1.1150021	1.6544423	
		2	3	.13460543	.13074375	.734	-.2312495	.5004604	
			4	2.2438945*	.18207762	.000	1.7178857	2.7699033	
			3	1	1.2501168*	.12953041	.000	.8874289	1.6128047
				2	-.13460543	.13074375	.734	-.5004604	.2312495
		4	4	2.1092891*	.20109475	.000	1.5445317	2.6740465	
			1	-.8591723*	.18120833	.001	-1.3835174	-.3348272	
			2	-2.243894*	.18207762	.000	-2.7699033	-1.7178857	
			3	-2.109289*	.20109475	.000	-2.6740465	-1.5445317	

\*. The mean difference is significant at the 0.05 level.

## B.2 Emotional Responses: Pilot Study

### B.2.1 Normality Test

#### *Privacy Concern 1: Inadvertent Disclosure of Personal Information*

Tests of Normality

	Situation	Shapiro-Wilk		
		Statistic	df	Sig.
Interest	1.00	.539	10	.000
	2.00	.539	10	.000
	3.00	.366	10	.000
Compassion	1.00	.366	10	.000
	3.00	.532	10	.000
Sadness	1.00	.786	10	.010
	2.00	.791	10	.011
	3.00	.575	10	.000
Guilt	1.00	.366	10	.000
	2.00	.366	10	.000
Regret	1.00	.820	10	.025
	2.00	.727	10	.002
	3.00	.770	10	.006
Shame	1.00	.516	10	.000
	2.00	.366	10	.000
	3.00	.366	10	.000
Disappointment	1.00	.757	10	.004
	2.00	.745	10	.003
	3.00	.670	10	.000

	Situation	Shapiro-Wilk		
		Statistic	df	Sig.
Fear	1.00	.932	10	.466
	2.00	.841	10	.046
	3.00	.756	10	.004
Disgust	1.00	.804	10	.016
	2.00	.747	10	.003
	3.00	.841	10	.046
Contempt	1.00	.539	10	.000
	2.00	.720	10	.002
	3.00	.723	10	.002
Hate	1.00	.851	10	.060
	2.00	.782	10	.009
	3.00	.794	10	.012
Anger	1.00	.845	10	.050
	2.00	.647	10	.000
	3.00	.773	10	.007

#### *Privacy Concern 2: Damaged Reputation Due to Rumours/Gossip*

Tests of Normality

	Situation	Shapiro-Wilk		
		Statistic	df	Sig.
Interest	4.00	.366	10	.000
	5.00	.509	10	.000
	6.00	.366	10	.000
Amusement	4.00	.366	10	.000
	5.00	.509	10	.000
	6.00	.628	10	.000
Pride	5.00	.509	10	.000
Joy	5.00	.366	10	.000
	6.00	.366	10	.000
Pleasure	4.00	.475	10	.000
	5.00	.509	10	.000
	6.00	.532	10	.000
Contentment	5.00	.509	10	.000
Love	5.00	.509	10	.000
	6.00	.366	10	.000
Admiration	5.00	.532	10	.000
	6.00	.366	10	.000
Compassion	4.00	.366	10	.000
	5.00	.366	10	.000
	6.00	.366	10	.000
Sadness	4.00	.845	10	.050
	5.00	.783	10	.009
	6.00	.810	10	.019
Guilt	4.00	.848	10	.055
	5.00	.867	10	.091
	6.00	.771	10	.006

	Situation	Shapiro-Wilk		
		Statistic	df	Sig.
Regret	4.00	.663	10	.000
	5.00	.860	10	.076
	6.00	.626	10	.000
Shame	4.00	.652	10	.000
	5.00	.527	10	.000
	6.00	.730	10	.002
Disappointment	4.00	.646	10	.000
	5.00	.771	10	.006
	6.00	.724	10	.002
Fear	4.00	.848	10	.056
	5.00	.789	10	.011
	6.00	.721	10	.002
Disgust	4.00	.867	10	.092
	5.00	.885	10	.149
	6.00	.806	10	.017
Contempt	4.00	.766	10	.006
	5.00	.881	10	.136
	6.00	.714	10	.001
Hate	4.00	.860	10	.076
	5.00	.737	10	.002
	6.00	.814	10	.022
Anger	4.00	.766	10	.006
	5.00	.575	10	.000
	6.00	.722	10	.002

\* Cases with constant values have been omitted.

**Privacy Concern 3: Unwanted Contact and Harassment/Stalking**

## Tests of Normality

	Situation	Shapiro-Wilk		
		Statistic	df	Sig.
Interest	7.00	.647	10	.000
	8.00	.536	10	.000
	9.00	.539	10	.000
Amusement	7.00	.500	10	.000
	8.00	.366	10	.000
	9.00	.366	10	.000
Pride	7.00	.366	10	.000
	9.00	.509	10	.000
Joy	7.00	.366	10	.000
Pleasure	7.00	.366	10	.000
	8.00	.366	10	.000
Contentment	7.00	.366	10	.000
	8.00	.366	10	.000
	9.00	.366	10	.000
Love	7.00	.366	10	.000
Admiration	7.00	.366	10	.000
	8.00	.366	10	.000
Relief	7.00	.509	10	.000
	8.00	.366	10	.000
	9.00	.366	10	.000
Compassion	7.00	.500	10	.000
	8.00	.532	10	.000
Sadness	7.00	.719	10	.001
	8.00	.659	10	.000
	9.00	.606	10	.000

	Situation	Shapiro-Wilk		
		Statistic	df	Sig.
Guilt	7.00	.456	10	.000
	8.00	.650	10	.000
Regret	7.00	.611	10	.000
	8.00	.682	10	.001
	9.00	.509	10	.000
Shame	7.00	.456	10	.000
	8.00	.509	10	.000
Disappointment	7.00	.735	10	.002
	8.00	.778	10	.008
	9.00	.703	10	.001
Fear	7.00	.847	10	.053
	8.00	.776	10	.007
	9.00	.652	10	.000
Disgust	7.00	.872	10	.106
	8.00	.804	10	.016
	9.00	.803	10	.016
Contempt	7.00	.867	10	.092
	8.00	.789	10	.011
	9.00	.916	10	.321
Hate	7.00	.794	10	.012
	8.00	.799	10	.014
	9.00	.809	10	.019
Anger	7.00	.905	10	.246
	8.00	.888	10	.160
	9.00	.735	10	.002

**Privacy Concern 4: Surveillance-like Structure**

## Tests of Normality

	Situation	Shapiro-Wilk		
		Statistic	df	Sig.
Interest	10.00	.794	10	.012
	11.00	.850	10	.058
	12.00	.857	10	.070
Amusement	10.00	.730	10	.002
	11.00	.650	10	.000
	12.00	.366	10	.000
Pride	10.00	.500	10	.000
	11.00	.624	10	.000
	12.00	.532	10	.000
Joy	10.00	.650	10	.000
	11.00	.717	10	.001
	12.00	.500	10	.000
Pleasure	10.00	.781	10	.008
	11.00	.650	10	.000
	12.00	.640	10	.000
Contentment	10.00	.647	10	.000
	11.00	.747	10	.003
	12.00	.605	10	.000
Love	10.00	.366	10	.000
	11.00	.532	10	.000
	12.00	.366	10	.000
Admiration	10.00	.366	10	.000
	11.00	.509	10	.000
	12.00	.366	10	.000
Relief	10.00	.532	10	.000
	11.00	.366	10	.000
	12.00	.366	10	.000

	Situation	Shapiro-Wilk		
		Statistic	df	Sig.
Compassion	10.00	.650	10	.000
	11.00	.647	10	.000
	12.00	.366	10	.000
Sadness	10.00	.366	10	.000
	11.00	.366	10	.000
Guilt	10.00	.500	10	.000
	11.00	.647	10	.000
Regret	10.00	.509	10	.000
	11.00	.475	10	.000
	12.00	.366	10	.000
Fear	10.00	.509	10	.000
	11.00	.655	10	.000
	12.00	.475	10	.000
Disgust	10.00	.594	10	.000
	11.00	.539	10	.000
	12.00	.366	10	.000
Contempt	10.00	.366	10	.000
	11.00	.624	10	.000
Hate	10.00	.366	10	.000
	11.00	.652	10	.000
Anger	10.00	.500	10	.000
	11.00	.735	10	.002
	12.00	.366	10	.000

\* Cases with constant values have been omitted.

## B.2.2 Kruskal-Wallis Test

### Privacy Concern 1: Inadvertent Disclosure of Personal Information

Test Statistics<sup>a,b</sup>

	Interest	Amusement	Pride	Joy	Pleasure	Contentment	Love	Admiration	Relief	Compassion
Chi-Square	.485	.000	.000	.000	.000	.000	.000	.000	.000	2.008
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.785	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.366

	Sadness	Guilt	Regret	Shame	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Chi-Square	.723	1.038	.718	.562	.536	4.052	.803	.754	.382	3.228
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.697	.595	.698	.755	.765	.132	.669	.686	.826	.199

a. Kruskal Wallis Test

b. Grouping Variable: Situation

### Privacy Concern 2: Damaged Reputation Due to Rumours/Gossip

Test Statistics<sup>a,b</sup>

	Interest	Amusement	Pride	Joy	Pleasure	Contentment	Love	Admiration	Relief	Compassion
Chi-Square	.558	1.551	4.143	1.038	.041	4.143	2.010	2.074	.000	.010
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.757	.460	.126	.595	.980	.126	.366	.355	1.000	.995

	Sadness	Guilt	Regret	Shame	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Chi-Square	.064	.053	2.813	.183	.386	1.784	.285	.538	.117	1.102
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.968	.974	.245	.912	.824	.410	.867	.764	.943	.576

a. Kruskal Wallis Test

b. Grouping Variable: Situation

### Privacy Concern 3: Unwanted Contact and Harassment/Stalking

Test Statistics<sup>a,b</sup>

	Interest	Amusement	Pride	Joy	Pleasure	Contentment	Love	Admiration	Relief	Compassion
Chi-Square	.173	.554	2.148	2.000	1.036	.007	2.000	1.036	.558	2.220
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.917	.758	.342	.368	.596	.996	.368	.596	.757	.330

	Sadness	Guilt	Regret	Shame	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Chi-Square	.522	3.215	2.175	2.218	1.355	3.687	.254	1.761	.700	.316
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.770	.200	.337	.330	.508	.158	.881	.415	.705	.854

a. Kruskal Wallis Test

b. Grouping Variable: Situation

### Privacy Concern 4: Surveillance-like Structure

Test Statistics<sup>a,b</sup>

	Interest	Amusement	Pride	Joy	Pleasure	Contentment	Love	Admiration	Relief	Compassion
Chi-Square	2.911	1.899	.403	.788	.718	1.698	.512	.571	.512	1.659
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.233	.387	.817	.674	.698	.428	.774	.752	.774	.436

	Sadness	Guilt	Regret	Shame	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Chi-Square	1.038	3.217	.518	2.230	2.330	.710	1.104	4.111	4.231	2.988
df	2	2	2	2	2	2	2	2	2	2
Asymp. Sig.	.595	.200	.772	.328	.312	.701	.576	.128	.121	.224

a. Kruskal Wallis Test

b. Grouping Variable: Situation

## B.3 Emotional Responses: Main Study

### B.3.1 Normality Test

#### *Situation 1: Inadvertent Disclosure of Personal Information*

Tests of Normality

	Cluster	Shapiro-Wilk				Cluster	Shapiro-Wilk		
		Statistic	df	Sig.			Statistic	df	Sig.
Interest	1	.466	13	.000	Fear	1	.810	13	.009
	3	.644	13	.000		2	.824	12	.018
	4	.327	12	.000		3	.649	13	.000
Amusement	3	.311	13	.000	4	.728	12	.002	
Compassion	1	.311	13	.000	Disgust	1	.905	13	.158
	3	.446	13	.000		2	.465	12	.000
	4	.327	12	.000		3	.799	13	.007
Sadness	1	.904	13	.153	4	.724	12	.001	
	3	.826	13	.014	Contempt	1	.647	13	.000
	4	.537	12	.000		2	.465	12	.000
Guilt	1	.311	13	.000		3	.688	13	.000
	3	.446	13	.000	4	.668	12	.000	
	Regret	1	.887	13	.089	Hate	1	.866	13
3		.836	13	.019	2		.465	12	.000
4		.327	12	.000	3		.806	13	.008
Shame	1	.443	13	.000	4	.844	12	.031	
	3	.611	13	.000	Anger	1	.790	13	.005
	4	.327	12	.000		2	.659	12	.000
Disappointment	1	.707	13	.001		3	.708	13	.001
	2	.644	12	.000	4	.552	12	.000	
	3	.772	13	.003					
4	.641	12	.000						

#### *Situation 2: Damaged Reputation Due to Rumours/Gossip*

Tests of Normality

	Cluster	Shapiro-Wilk				Cluster	Shapiro-Wilk		
		Statistic	df	Sig.			Statistic	df	Sig.
Interest	1	.446	13	.000	Regret	1	.646	13	.000
	3	.446	13	.000		2	.327	12	.000
	4	.465	12	.000		3	.709	13	.001
Amusement	2	.465	12	.000	4	.762	12	.004	
	3	.574	13	.000	Shame	1	.446	13	.000
	4	.809	12	.012		2	.910	12	.213
Pride	1	.446	13	.000		3	.311	13	.000
	4	.465	12	.000	4	.640	12	.000	
	Joy	3	.446	13	.000	Disappointment	1	.446	13
4		.465	12	.000	3		.628	13	.000
Pleasure		1	.446	13	.000		4	.760	12
	3	.446	13	.000	Fear	1	.792	13	.005
	4	.873	12	.071		3	.811	13	.009
Contentment	1	.446	13	.000		4	.465	12	.000
	4	.465	12	.000	Disgust	1	.799	13	.007
	Love	1	.446	13		.000	2	.575	12
3		.446	13	.000		3	.753	13	.002
4		.465	12	.000	4	.665	12	.000	
Admiration	3	.592	13	.000	Contempt	1	.811	13	.009
	4	.465	12	.000		2	.547	12	.000
Compassion	1	.311	13	.000		3	.774	13	.003
	3	.446	13	.000	4	.681	12	.001	
	4	.465	12	.000	Hate	1	.722	13	.001
Sadness	1	.829	13	.016		3	.799	13	.007
	2	.465	12	.000		4	.732	12	.002
	3	.688	13	.000	Anger	1	.446	13	.000
4	.552	12	.000	2		.781	12	.006	
Guilt	1	.768	13	.003		3	.592	13	.000
	2	.327	12	.000	4	.869	12	.063	
	3	.810	13	.009					
	4	.763	12	.004					

\* Cases with constant values have been omitted.



**Situation 3: Unwanted Contact and Harassment/Stalking**

Tests of Normality

	Cluster	Shapiro-Wilk		
		Statistic	df	Sig.
Interest	1	.311	13	.000
	3	.668	13	.000
	4	.884	12	.100
Amusement	3	.638	13	.000
	4	.729	12	.002
Pride	2	.327	12	.000
	3	.533	13	.000
Joy	3	.446	13	.000
Pleasure	2	.327	12	.000
	3	.446	13	.000
Contentment	3	.700	13	.001
Love	1	.311	13	.000
	3	.446	13	.000
Admiration	3	.446	13	.000
	4	.608	12	.000
Relief	2	.327	12	.000
	3	.446	13	.000
	4	.608	12	.000
	4	.608	12	.000
Compassion	1	.311	13	.000
	3	.638	13	.000
	4	.465	12	.000
Sadness	1	.562	13	.000
	3	.810	13	.009
	4	.608	12	.000
Guilt	1	.649	13	.000
	3	.638	13	.000
Regret	1	.688	13	.000
	3	.707	13	.001

	Cluster	Shapiro-Wilk		
		Statistic	df	Sig.
Shame	1	.574	13	.000
	3	.604	13	.000
Disappointment	1	.446	13	.000
	2	.750	12	.003
	3	.759	13	.002
	4	.465	12	.000
Fear	1	.848	13	.027
	2	.590	12	.000
	3	.811	13	.009
	4	.708	12	.001
Disgust	1	.762	13	.003
	2	.552	12	.000
	3	.821	13	.012
	4	.552	12	.000
Contempt	1	.846	13	.026
	2	.479	12	.000
	3	.850	13	.028
	4	.718	12	.001
Hate	1	.859	13	.037
	2	.753	12	.003
	3	.924	13	.280
	4	.770	12	.004
Anger	1	.311	13	.000
	2	.687	12	.001
	3	.944	13	.506
	4	.868	12	.062

**Situation 4: Surveillance-like Structure**

Tests of Normality

	Cluster	Shapiro-Wilk		
		Statistic	df	Sig.
Interest	1	.812	13	.010
	2	.745	12	.002
	3	.825	13	.014
	4	.718	12	.001
Amusement	3	.874	13	.059
	4	.829	12	.020
Pride	3	.831	13	.016
	4	.855	12	.043
Joy	3	.896	13	.116
	4	.811	12	.012
Pleasure	1	.311	13	.000
	3	.811	13	.009
	4	.774	12	.005
Contentment	1	.633	13	.000
	2	.327	12	.000
	3	.741	13	.001
	4	.777	12	.005
Love	3	.705	13	.001
	4	.465	12	.000
Admiration	3	.705	13	.001
	4	.465	12	.000
Relief	1	.446	13	.000
	3	.763	13	.003
Compassion	1	.533	13	.000
	3	.746	13	.002
	4	.465	12	.000
Sadness	3	.604	13	.000

	Cluster	Shapiro-Wilk		
		Statistic	df	Sig.
Guilt	1	.446	13	.000
	3	.763	13	.003
Regret	1	.446	13	.000
	2	.465	12	.000
	3	.592	13	.000
Shame	1	.446	13	.000
	3	.628	13	.000
Disappointment	1	.446	13	.000
	2	.552	12	.000
	3	.446	13	.000
	4	.465	12	.000
Fear	1	.610	13	.000
	3	.735	13	.001
	4	.327	12	.000
Disgust	1	.504	13	.000
	3	.707	13	.001
Contempt	1	.446	13	.000
	3	.604	13	.000
	4	.465	12	.000
Hate	1	.446	13	.000
	3	.638	13	.000
	4	.465	12	.000
Anger	1	.446	13	.000
	2	.725	12	.002
	3	.592	13	.000
	4	.575	12	.000

\* Cases with constant values have been omitted.

## B.3.2 Kruskal-Wallis Test and Mann-Whitney *U* Tests

### B.3.2.1 Situation 1: Inadvertent Disclosure of Personal Information

#### *Kruskal-Wallis Test*

Test Statistics<sup>a,b</sup>

	Interest	Amusement	Pride	Joy	Pleasure	Contentment	Love	Admiration	Relief	Compassion
Chi-Square	5.642	2.846	.000	.000	.000	.000	.000	.000	.000	1.964
df	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.130	.416	1.000	1.000	1.000	1.000	1.000	1.000	1.000	.580

	Sadness	Guilt	Regret	Shame	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Chi-Square	23.001	3.450	24.564	5.546	4.655	14.285	16.509	6.409	19.825	13.874
df	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.000	.327	.000	.136	.199	.003	.001	.093	.000	.003

a. Kruskal Wallis Test

b. Grouping Variable: Cluster

#### *Mann-Whitney U Tests*

##### Cluster 1 - Cluster 2

Test Statistics<sup>a</sup>

	Sadness	Regret	Fear	Disgust	Hate	Anger
Mann-Whitney U	18.000	24.000	44.000	22.000	10.000	20.000
Wilcoxon W	96.000	102.000	122.000	100.000	88.000	98.000
Z	-3.696	-3.431	-1.927	-3.303	-3.899	-3.247
Asymp. Sig. (2-tailed)	.000	.001	.054	.001	.000	.001
Exact Sig. [2*(1-tailed Sig.)]	.001 <sup>b</sup>	.002 <sup>b</sup>	.068 <sup>b</sup>	.002 <sup>b</sup>	.000 <sup>b</sup>	.001 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

##### Cluster 1 - Cluster 3

Test Statistics<sup>a</sup>

	Sadness	Regret	Fear	Disgust	Hate	Anger
Mann-Whitney U	55.000	57.500	36.000	68.000	63.500	82.500
Wilcoxon W	146.000	148.500	127.000	159.000	154.500	173.500
Z	-1.538	-1.417	-2.645	-.867	-1.107	-.113
Asymp. Sig. (2-tailed)	.124	.156	.008	.386	.268	.910
Exact Sig. [2*(1-tailed Sig.)]	.139 <sup>b</sup>	.169 <sup>b</sup>	.012 <sup>b</sup>	.418 <sup>b</sup>	.287 <sup>b</sup>	.920 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

**Cluster 1 - Cluster 4**Test Statistics<sup>a</sup>

	Sadness	Regret	Fear	Disgust	Hate	Anger
Mann-Whitney U	39.500	34.000	67.500	50.500	76.000	66.000
Wilcoxon W	117.500	112.000	158.500	128.500	154.000	157.000
Z	-2.228	-2.711	-.583	-1.560	-.114	-.741
Asymp. Sig. (2-tailed)	.026	.007	.560	.119	.910	.458
Exact Sig. [2*(1-tailed Sig.)]	.035 <sup>b</sup>	.016 <sup>b</sup>	.574 <sup>b</sup>	.137 <sup>b</sup>	.936 <sup>b</sup>	.538 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

**Cluster 2 - Cluster 3**Test Statistics<sup>a</sup>

	Sadness	Regret	Fear	Disgust	Hate	Anger
Mann-Whitney U	12.000	12.000	14.500	16.000	21.000	18.000
Wilcoxon W	90.000	90.000	92.500	94.000	99.000	96.000
Z	-3.987	-3.976	-3.575	-3.611	-3.358	-3.402
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.001	.001
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>b</sup>	.000 <sup>b</sup>	.000 <sup>b</sup>	.000 <sup>b</sup>	.001 <sup>b</sup>	.001 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

**Cluster 2 - Cluster 4**Test Statistics<sup>a</sup>

	Sadness	Regret	Fear	Disgust	Hate	Anger
Mann-Whitney U	54.000	66.000	47.500	50.000	10.000	37.500
Wilcoxon W	132.000	144.000	125.500	128.000	88.000	115.500
Z	-1.809	-1.000	-1.478	-1.584	-3.805	-2.149
Asymp. Sig. (2-tailed)	.070	.317	.140	.113	.000	.032
Exact Sig. [2*(1-tailed Sig.)]	.319 <sup>b</sup>	.755 <sup>b</sup>	.160 <sup>b</sup>	.219 <sup>b</sup>	.000 <sup>b</sup>	.045 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

**Cluster 3 - Cluster 4**Test Statistics<sup>a</sup>

	Sadness	Regret	Fear	Disgust	Hate	Anger
Mann-Whitney U	27.000	21.500	45.500	40.500	57.000	75.000
Wilcoxon W	105.000	99.500	123.500	118.500	135.000	166.000
Z	-2.953	-3.344	-1.888	-2.129	-1.179	-.197
Asymp. Sig. (2-tailed)	.003	.001	.059	.033	.239	.844
Exact Sig. [2*(1-tailed Sig.)]	.005 <sup>b</sup>	.001 <sup>b</sup>	.077 <sup>b</sup>	.040 <sup>b</sup>	.270 <sup>b</sup>	.894 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.



### B.3.2.2 Situation 2: Damaged Reputation Due to Rumours/Gossip

#### Kruskal-Wallis Test

Test Statistics<sup>a,b</sup>

	Interest	Amusement	Pride	Joy	Pleasure	Contentment	Love	Admiration	Relief	Compassion
Chi-Square	2.162	13.798	4.275	4.253	24.804	4.275	2.124	8.260	.000	2.218
df	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.540	.003	.233	.235	.000	.233	.547	.041	1.000	.528

	Sadness	Guilt	Regret	Shame	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Chi-Square	31.919	24.309	29.196	22.059	30.514	16.451	34.013	9.230	23.923	26.049
df	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.000	.000	.000	.000	.000	.001	.000	.026	.000	.000

a. Kruskal Wallis Test

b. Grouping Variable: Cluster

#### Mann-Whitney U Tests

##### Cluster 1 - Cluster 2

Test Statistics<sup>a</sup>

	Sadness	Guilt	Regret	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Mann-Whitney U	31.000	26.500	.000	.000	24.000	.000	33.000	24.000	12.500
Wilcoxon W	109.000	104.500	78.000	78.000	102.000	78.000	111.000	102.000	90.500
Z	-2.834	-3.192	-4.522	-4.729	-3.445	-4.380	-2.655	-3.450	-3.832
Asymp. Sig. (2-tailed)	.005	.001	.000	.000	.001	.000	.008	.001	.000
Exact Sig. [2*(1-tailed Sig.)]	.010 <sup>b</sup>	.004 <sup>b</sup>	.000 <sup>b</sup>	.000 <sup>b</sup>	.002 <sup>b</sup>	.000 <sup>b</sup>	.014 <sup>b</sup>	.002 <sup>b</sup>	.000 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

##### Cluster 1 - Cluster 3

Test Statistics<sup>a</sup>

	Sadness	Guilt	Regret	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Mann-Whitney U	25.000	68.000	75.000	70.000	80.500	82.000	73.500	77.000	71.500
Wilcoxon W	116.000	159.000	166.000	161.000	171.500	173.000	164.500	168.000	162.500
Z	-3.146	-.897	-.555	-.958	-.216	-.136	-.591	-.405	-.913
Asymp. Sig. (2-tailed)	.002	.370	.579	.338	.829	.892	.554	.686	.361
Exact Sig. [2*(1-tailed Sig.)]	.002 <sup>b</sup>	.418 <sup>b</sup>	.650 <sup>b</sup>	.479 <sup>b</sup>	.840 <sup>b</sup>	.920 <sup>b</sup>	.579 <sup>b</sup>	.724 <sup>b</sup>	.511 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

##### Cluster 1 - Cluster 4

Test Statistics<sup>a</sup>

	Sadness	Guilt	Regret	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Mann-Whitney U	40.500	46.000	57.500	38.000	72.000	4.000	43.000	60.000	16.000
Wilcoxon W	118.500	124.000	135.500	116.000	163.000	82.000	121.000	138.000	94.000
Z	-2.211	-1.800	-1.227	-2.465	-.342	-4.146	-2.033	-1.016	-3.656
Asymp. Sig. (2-tailed)	.027	.072	.220	.014	.732	.000	.042	.310	.000
Exact Sig. [2*(1-tailed Sig.)]	.040 <sup>b</sup>	.087 <sup>b</sup>	.270 <sup>b</sup>	.030 <sup>b</sup>	.769 <sup>b</sup>	.000 <sup>b</sup>	.060 <sup>b</sup>	.347 <sup>b</sup>	.000 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

**Cluster 2 - Cluster 3**Test Statistics<sup>a</sup>

	Sadness	Guilt	Regret	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Mann-Whitney U	.000	1.000	.500	.000	24.000	7.500	46.000	.000	18.500
Wilcoxon W	78.000	79.000	78.500	78.000	102.000	85.500	124.000	78.000	96.500
Z	-4.467	-4.419	-4.497	-4.602	-3.438	-3.999	-1.970	-4.537	-3.438
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.001	.000	.049	.000	.001
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>b</sup>	.000 <sup>b</sup>	.000 <sup>b</sup>	.000 <sup>b</sup>	.002 <sup>b</sup>	.000 <sup>b</sup>	.087 <sup>b</sup>	.000 <sup>b</sup>	.001 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

**Cluster 2 - Cluster 4**Test Statistics<sup>a</sup>

	Sadness	Guilt	Regret	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Mann-Whitney U	63.000	36.500	8.500	24.000	12.000	62.000	62.000	6.000	69.500
Wilcoxon W	141.000	114.500	86.500	102.000	90.000	140.000	140.000	84.000	147.500
Z	-.733	-2.450	-3.948	-3.316	-4.053	-.721	-.720	-4.226	-.149
Asymp. Sig. (2-tailed)	.463	.014	.000	.001	.000	.471	.472	.000	.882
Exact Sig. [2*(1-tailed Sig.)]	.630 <sup>b</sup>	.039 <sup>b</sup>	.000 <sup>b</sup>	.005 <sup>b</sup>	.000 <sup>b</sup>	.590 <sup>b</sup>	.590 <sup>b</sup>	.000 <sup>b</sup>	.887 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

**Cluster 3 - Cluster 4**Test Statistics<sup>a</sup>

	Sadness	Guilt	Regret	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Mann-Whitney U	.000	15.500	51.000	43.500	74.000	11.000	53.000	42.000	19.000
Wilcoxon W	78.000	93.500	129.000	121.500	152.000	89.000	131.000	120.000	97.000
Z	-4.428	-3.457	-1.599	-2.031	-.233	-3.777	-1.503	-2.064	-3.383
Asymp. Sig. (2-tailed)	.000	.001	.110	.042	.815	.000	.133	.039	.001
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>b</sup>	.000 <sup>b</sup>	.152 <sup>b</sup>	.060 <sup>b</sup>	.852 <sup>b</sup>	.000 <sup>b</sup>	.186 <sup>b</sup>	.052 <sup>b</sup>	.001 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

### B.3.2.3 Situation 3: Unwanted Contact and Harassment/Stalking

#### Kruskal-Wallis Test

Test Statistics<sup>a,b</sup>

	Interest	Amusement	Pride	Joy	Pleasure	Contentment	Love	Admiration	Relief	Compassion
Chi-Square	19.752	14.553	6.067	5.811	3.667	18.949	3.555	9.085	6.873	5.193
df	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.000	.002	.108	.121	.300	.000	.314	.028	.076	.158

	Sadness	Guilt	Regret	Shame	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Chi-Square	13.616	8.605	23.072	7.463	25.693	4.681	12.293	15.380	2.781	23.770
df	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.003	.035	.000	.059	.000	.197	.006	.002	.427	.000

a. Kruskal Wallis Test

b. Grouping Variable: Cluster

#### Mann-Whitney U Tests

##### Cluster 1 - Cluster 2

Test Statistics<sup>a</sup>

	Disappointment	Disgust	Contempt	Anger
Mann-Whitney U	16.500	40.500	16.000	2.500
Wilcoxon W	94.500	118.500	94.000	80.500
Z	-3.578	-2.255	-3.607	-4.420
Asymp. Sig. (2-tailed)	.000	.024	.000	.000
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>b</sup>	.040 <sup>b</sup>	.000 <sup>b</sup>	.000 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

##### Cluster 1 - Cluster 3

Test Statistics<sup>a</sup>

	Disappointment	Disgust	Contempt	Anger
Mann-Whitney U	22.000	76.500	47.000	15.000
Wilcoxon W	113.000	167.500	138.000	106.000
Z	-3.593	-.423	-1.965	-3.891
Asymp. Sig. (2-tailed)	.000	.672	.049	.000
Exact Sig. [2*(1-tailed Sig.)]	.001 <sup>b</sup>	.687 <sup>b</sup>	.057 <sup>b</sup>	.000 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

### Cluster 1 - Cluster 4

Test Statistics<sup>a</sup>

	Disappointment	Disgust	Contempt	Anger
Mann-Whitney U	.000	40.500	38.000	15.000
Wilcoxon W	78.000	118.500	116.000	93.000
Z	-4.599	-2.255	-2.241	-3.807
Asymp. Sig. (2-tailed)	.000	.024	.025	.000
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>b</sup>	.040 <sup>b</sup>	.030 <sup>b</sup>	.000 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

### Cluster 2 - Cluster 3

Test Statistics<sup>a</sup>

	Disappointment	Disgust	Contempt	Anger
Mann-Whitney U	74.000	30.000	39.000	61.000
Wilcoxon W	152.000	108.000	117.000	139.000
Z	-.231	-2.749	-2.401	-.948
Asymp. Sig. (2-tailed)	.817	.006	.016	.343
Exact Sig. [2*(1-tailed Sig.)]	.852 <sup>b</sup>	.008 <sup>b</sup>	.035 <sup>b</sup>	.376 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

### Cluster 2 - Cluster 4

Test Statistics<sup>a</sup>

	Disappointment	Disgust	Contempt	Anger
Mann-Whitney U	45.000	67.500	45.000	53.000
Wilcoxon W	123.000	145.500	123.000	131.000
Z	-1.803	-.343	-1.865	-1.140
Asymp. Sig. (2-tailed)	.071	.732	.062	.254
Exact Sig. [2*(1-tailed Sig.)]	.128 <sup>b</sup>	.799 <sup>b</sup>	.128 <sup>b</sup>	.291 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

### Cluster 3 - Cluster 4

Test Statistics<sup>a</sup>

	Disappointment	Disgust	Contempt	Anger
Mann-Whitney U	47.000	33.000	67.000	61.500
Wilcoxon W	125.000	111.000	145.000	152.500
Z	-1.970	-2.586	-.632	-.919
Asymp. Sig. (2-tailed)	.049	.010	.528	.358
Exact Sig. [2*(1-tailed Sig.)]	.098 <sup>b</sup>	.014 <sup>b</sup>	.574 <sup>b</sup>	.376 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

### B.3.2.4 Situation 4: Surveillance-like Structure

#### Kruskal-Wallis Test

	Interest	Amusement	Pride	Joy	Pleasure	Contentment	Love	Admiration	Relief	Compassion
Chi-Square	19.510	26.149	22.185	26.707	30.727	5.858	13.888	13.177	13.732	8.029
df	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.000	.000	.000	.000	.000	.119	.003	.004	.003	.045

	Sadness	Guilt	Regret	Shame	Disappointment	Fear	Disgust	Contempt	Hate	Anger
Chi-Square	12.106	12.308	3.969	9.436	.488	9.569	11.532	4.122	3.809	5.477
df	3	3	3	3	3	3	3	3	3	3
Asymp. Sig.	.007	.006	.265	.024	.921	.023	.009	.249	.283	.140

a. Kruskal Wallis Test

b. Grouping Variable: Cluster

#### Mann-Whitney U Tests

##### Cluster 1 - Cluster 2

	Interest
Mann-Whitney U	25.500
Wilcoxon W	116.500
Z	-2.931
Asymp. Sig. (2-tailed)	.003
Exact Sig. [2*(1-tailed Sig.)]	.003 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

##### Cluster 1 - Cluster 3

	Interest
Mann-Whitney U	79.500
Wilcoxon W	170.500
Z	-.275
Asymp. Sig. (2-tailed)	.784
Exact Sig. [2*(1-tailed Sig.)]	.801 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

##### Cluster 1 - Cluster 4

	Interest
Mann-Whitney U	23.000
Wilcoxon W	114.000
Z	-3.050
Asymp. Sig. (2-tailed)	.002
Exact Sig. [2*(1-tailed Sig.)]	.002 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

##### Cluster 2 - Cluster 3

	Interest
Mann-Whitney U	25.000
Wilcoxon W	116.000
Z	-2.959
Asymp. Sig. (2-tailed)	.003
Exact Sig. [2*(1-tailed Sig.)]	.003 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

**Cluster 2 - Cluster 4**Test Statistics<sup>a</sup>

	Interest
Mann-Whitney U	33.500
Wilcoxon W	111.500
Z	-2.316
Asymp. Sig. (2-tailed)	.021
Exact Sig. [2*(1-tailed Sig.)]	.024 <sup>b</sup>

a. Grouping Variable: Cluster

b. Not corrected for ties.

**Cluster 3 - Cluster 4**Test Statistics<sup>a</sup>

	Interest
Mann-Whitney U	23.000
Wilcoxon W	114.000
Z	-3.053
Asymp. Sig. (2-tailed)	.002
Exact Sig. [2*(1-tailed Sig.)]	.002 <sup>b</sup>

a. Grouping Variable: Cluster

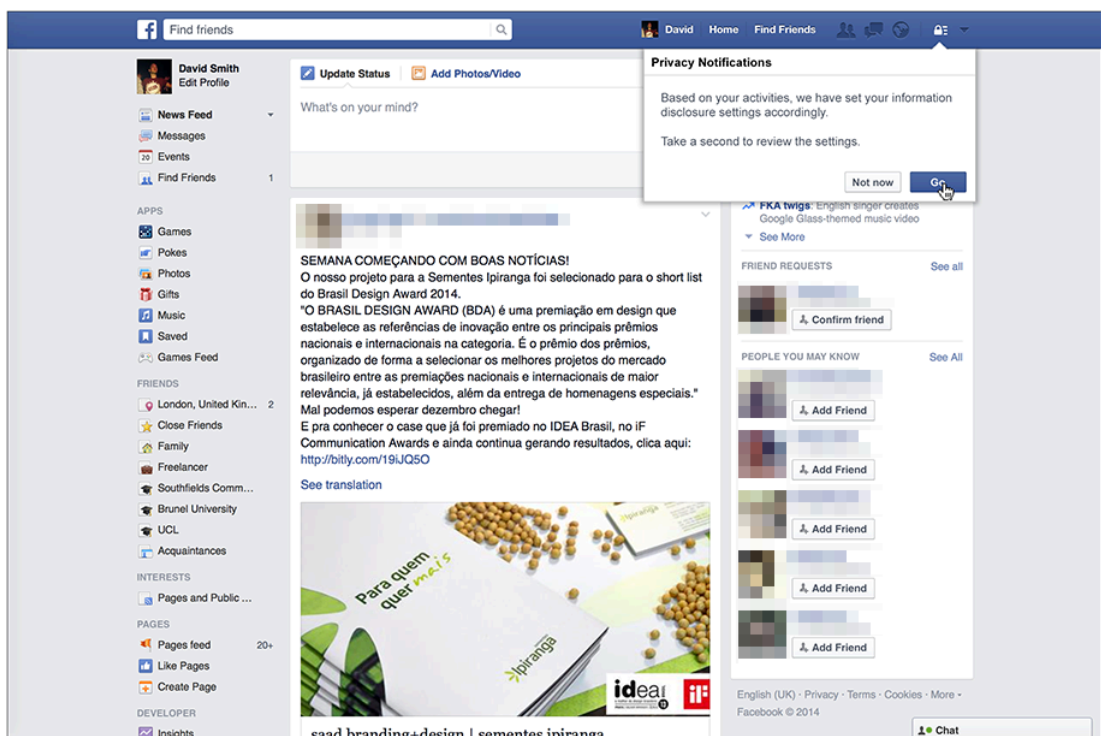
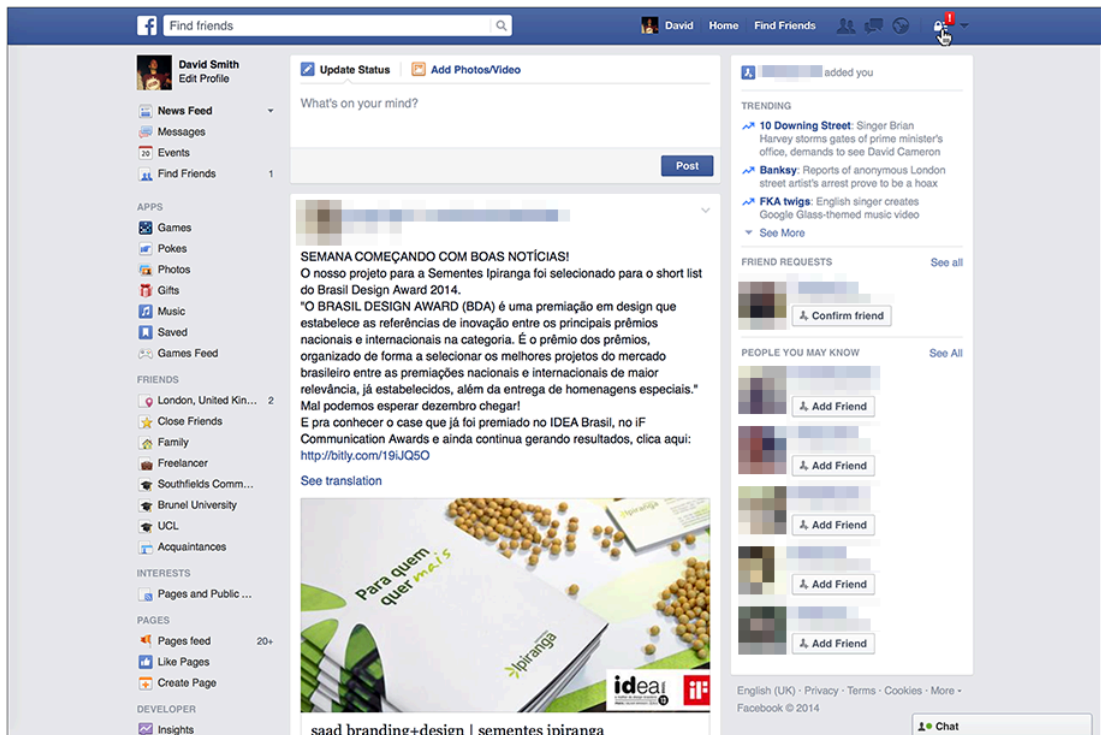
b. Not corrected for ties.

# Appendix C. Validate

## C.1 Software Agent Prototype Design Variations

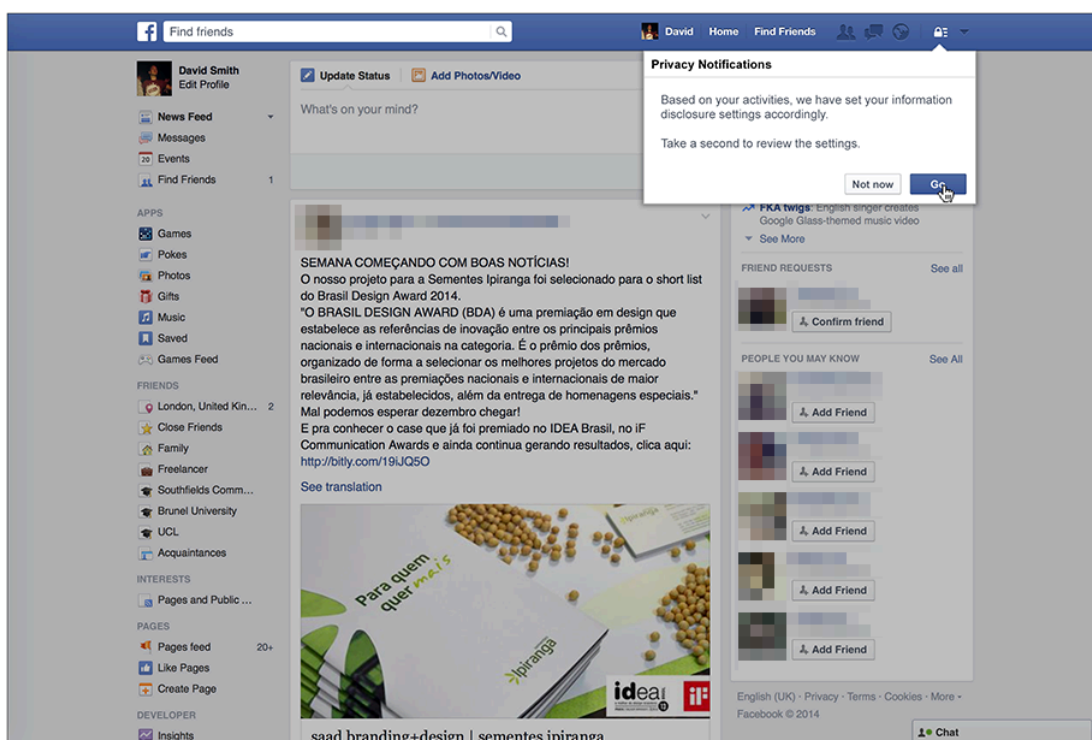
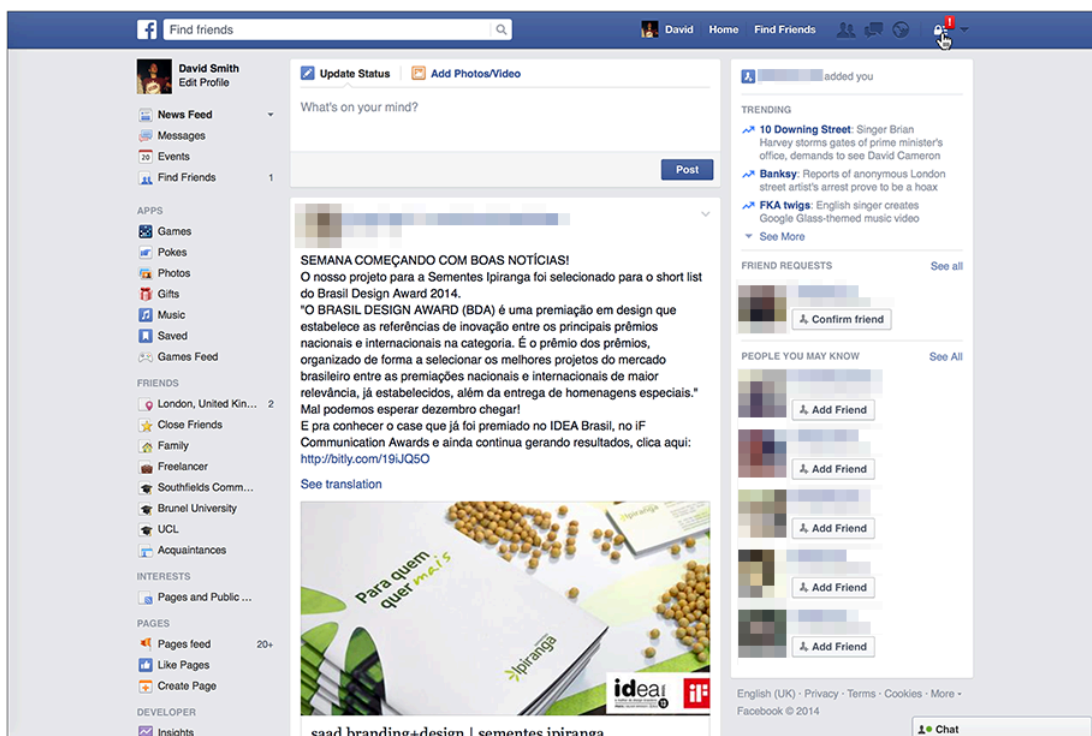
### C.1.1 Privacy Notifications

#### Variation 1



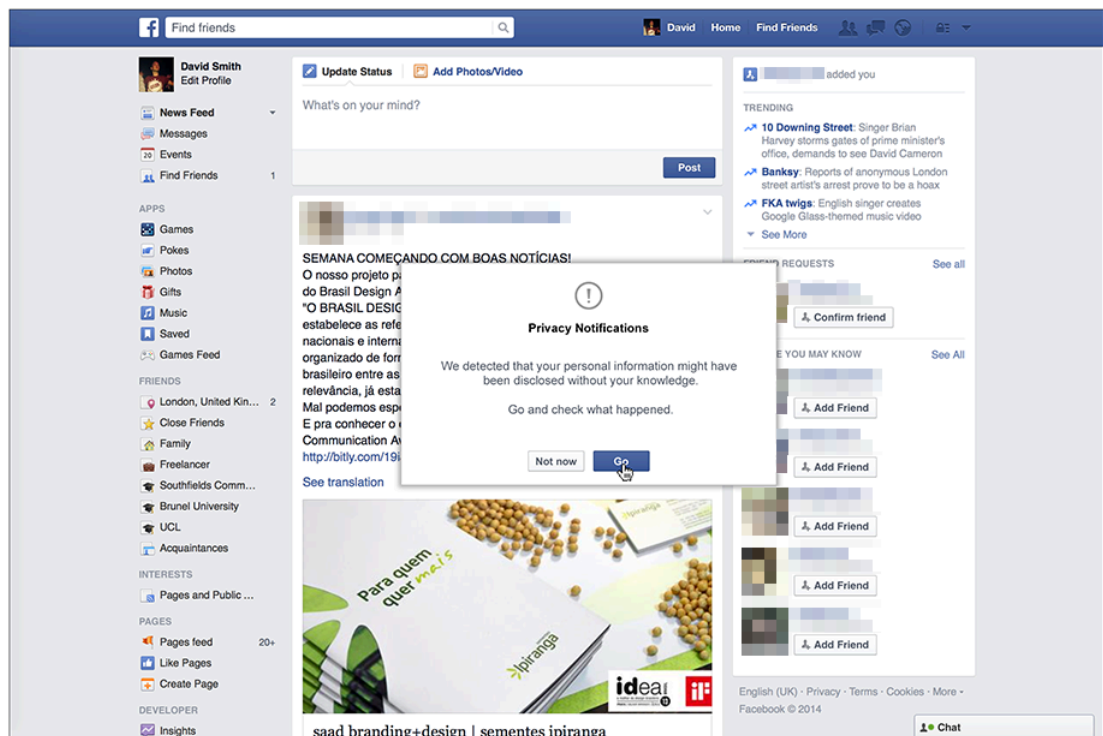


Variation 2

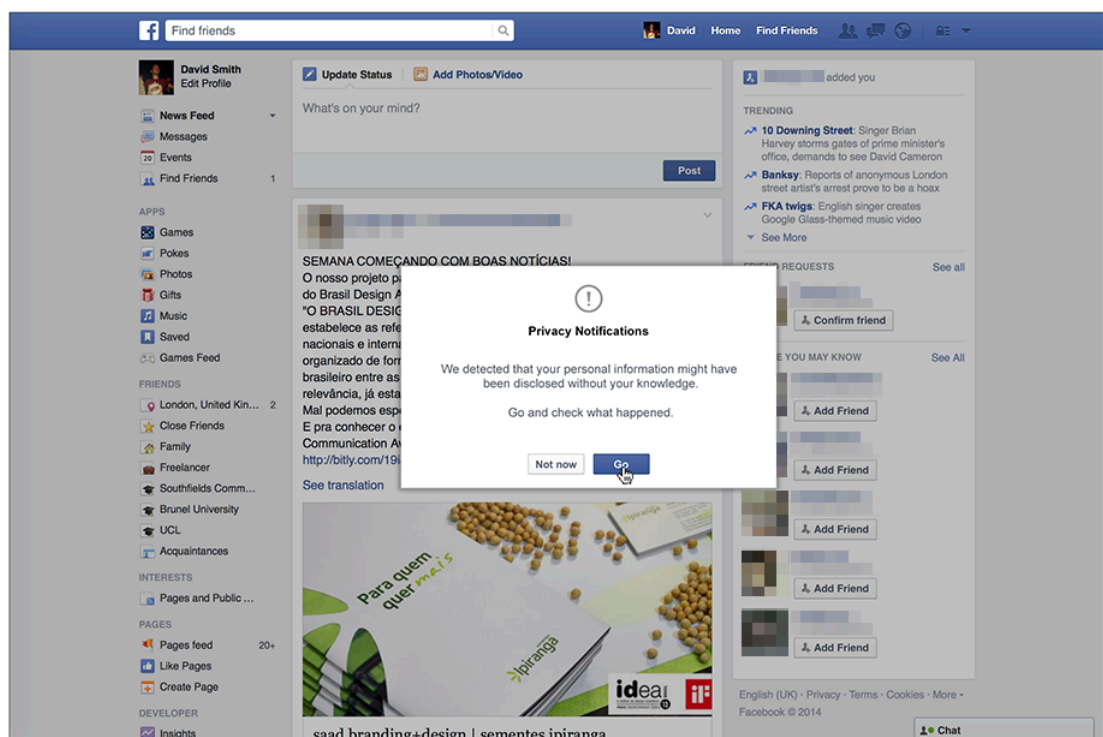




## Variation 3



## Variation 4

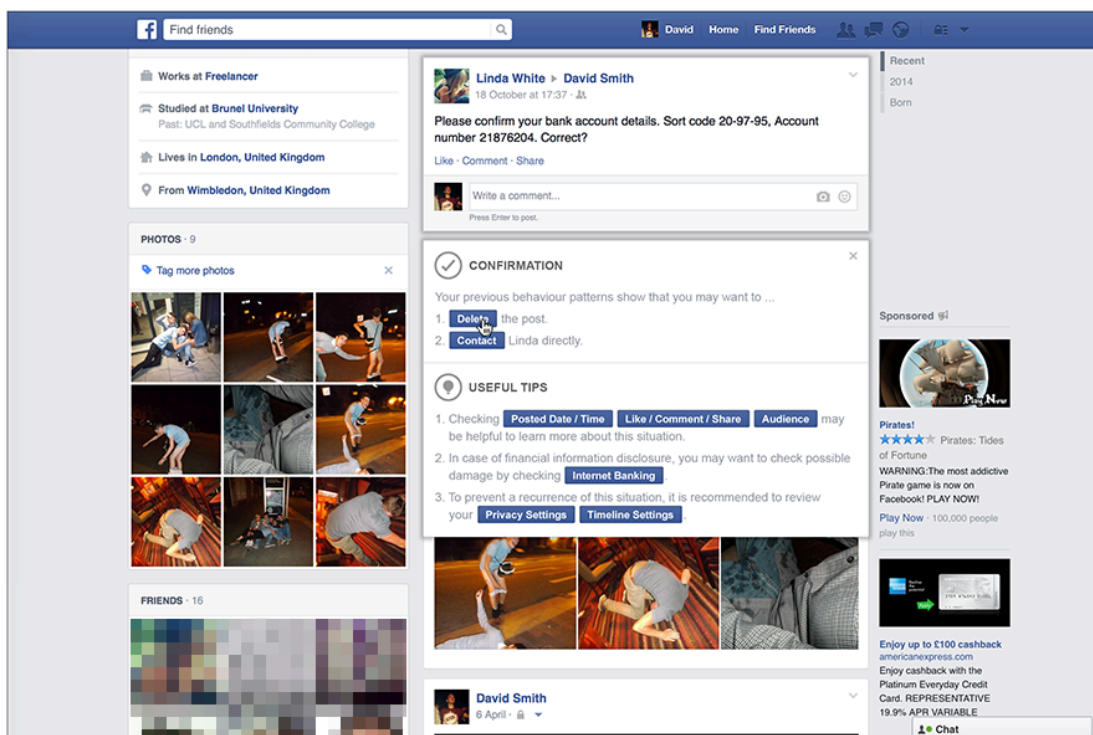


### Variation 5

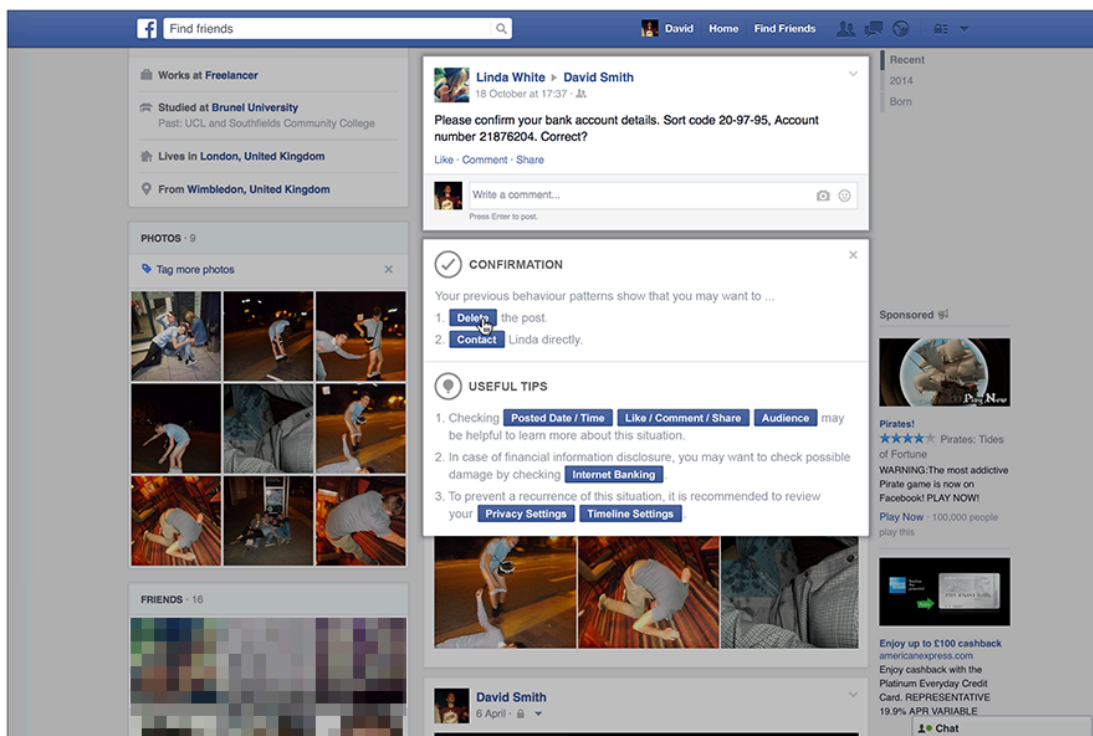
The screenshot displays a Facebook profile for David Smith. The top navigation bar includes the search bar with 'Find friends', the user's name 'David', and navigation links for 'Home' and 'Find Friends'. The left sidebar contains profile information: 'Works at Freelancer', 'Studied at Brunel University' (with a note 'Past: UCL and Southfields Community College'), 'Lives in London, United Kingdom', and 'From Wimbledon, United Kingdom'. Below this is a 'PHOTOS' section with a 'Tag more photos' link and a grid of 9 photos showing people in various poses. A 'FRIENDS' section below shows 16 friends with blurred avatars. The main content area features a security alert from Linda White to David Smith, dated 18 October at 17:37, asking to confirm bank account details (Sort code 20-97-95, Account number 21876204). Below the alert is a comment box. The next post is from Linda White, dated 16 May, titled 'Linda White added 9 new photos — with David Smith', showing a larger photo album. The right sidebar includes a 'Recent' section with '2014 Born', a 'Sponsored' section with an advertisement for 'Pirates! Tides of Fortune' (warning of an addictive game), and an advertisement for 'Enjoy up to £100 cashback' from American Express.

## C.1.2 User Type-Based Software Agent

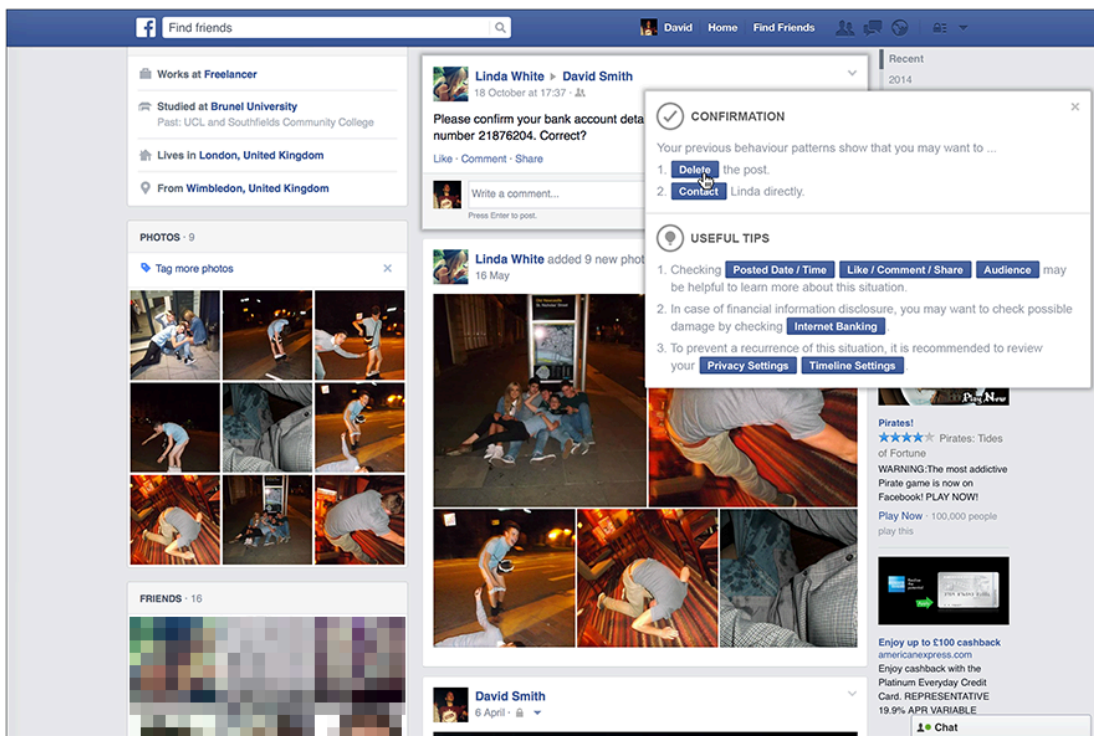
### Variation 1



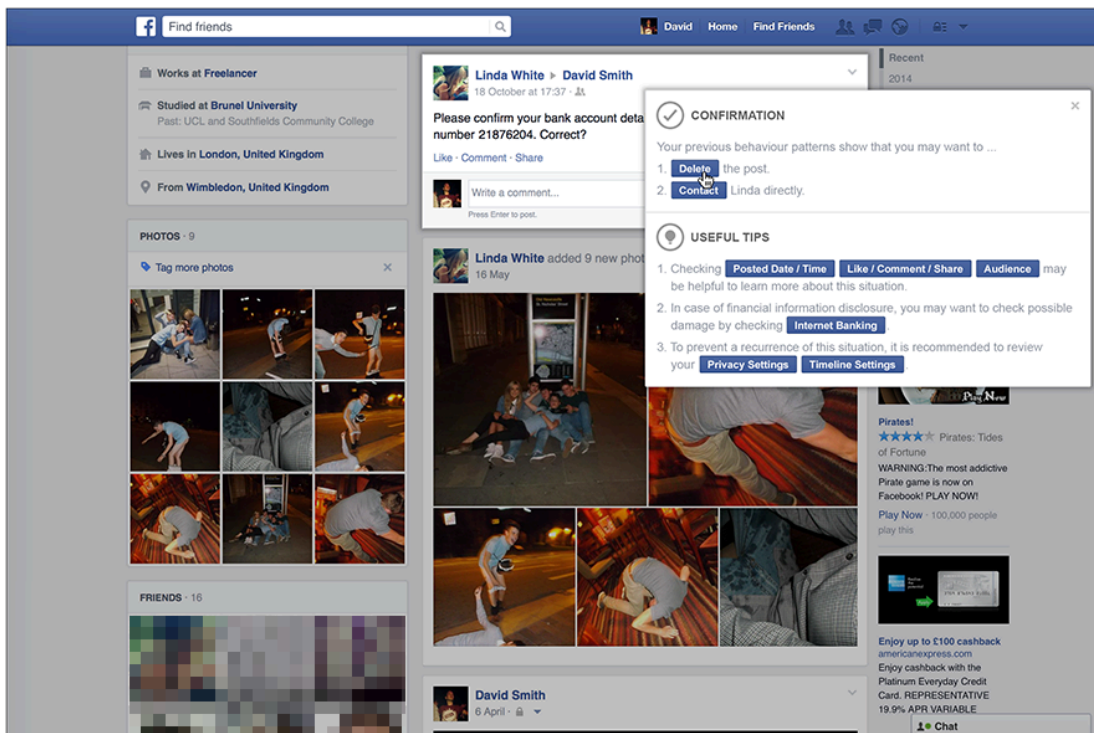
### Variation 2



### Variation 3



### Variation 4



## C.2 Software Agent Prototypes

### Privacy Notification Icon

Find friends

David Smith  
Edit Profile

Update Status Add Photos/Video

What's on your mind?

Post

SEMANA COMEÇANDO COM BOAS NOTÍCIAS!  
O nosso projeto para a Sementes Ipiranga foi selecionado para o short list do Brasil Design Award 2014.  
"O BRASIL DESIGN AWARD (BDA) é uma premiação em design que estabelece as referências de inovação entre os principais prêmios nacionais e internacionais na categoria. É o prêmio dos prêmios, organizado de forma a selecionar os melhores projetos do mercado brasileiro entre as premiações nacionais e internacionais de maior relevância, já estabelecidos, além da entrega de homenagens especiais."  
Mas podemos esperar dezembro chegar!  
E pra conhecer o case que já foi premiado no IDEA Brasil, no iF Communication Awards e ainda continua gerando resultados, clica aqui: <http://bitly.com/19JQ5O>  
[See translation](#)

Para quem quer mais  
Ipiranga  
idea

saad branding+design | sementes ipiranga

added you

TRENDING

- 10 Downing Street: Singer Brian Harvey storms gates of prime minister's office, demands to see David Cameron
- Banksy: Reports of anonymous London street artist's arrest prove to be a hoax
- FKA twigs: English singer creates Google Glass-themed music video

See More

FRIEND REQUESTS [See all](#)

Confirm friend

PEOPLE YOU MAY KNOW [See All](#)

Add Friend

Add Friend

Add Friend

Add Friend

Add Friend

English (UK) · Privacy · Terms · Cookies · More

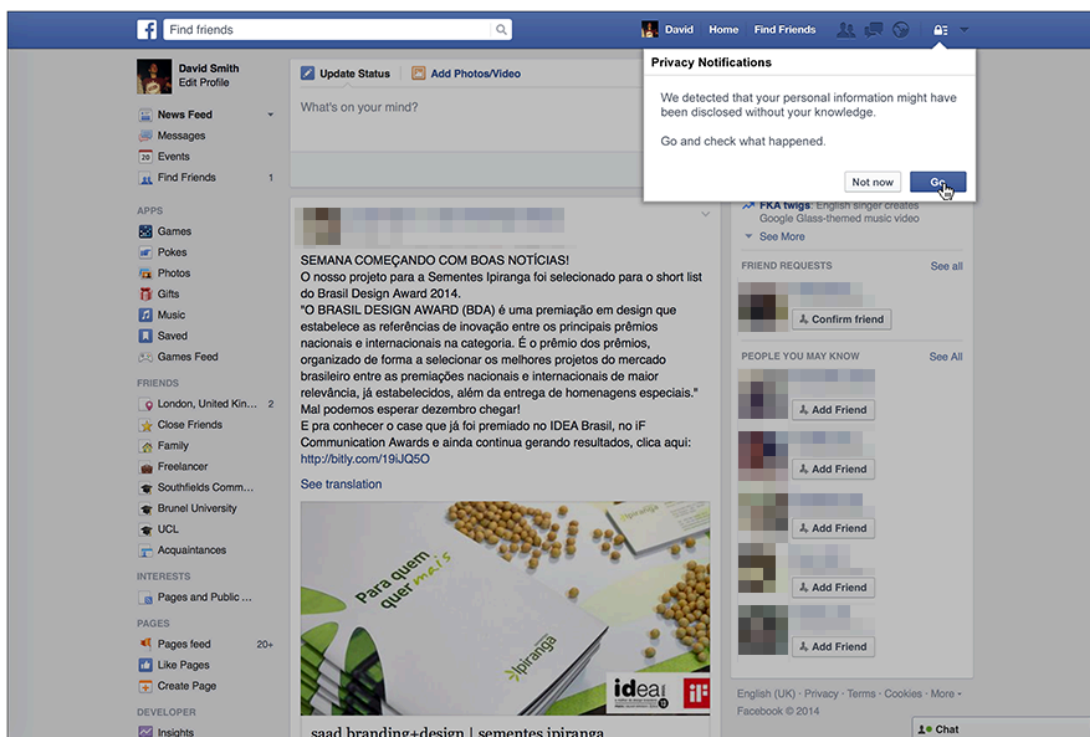
Facebook © 2014

Chat

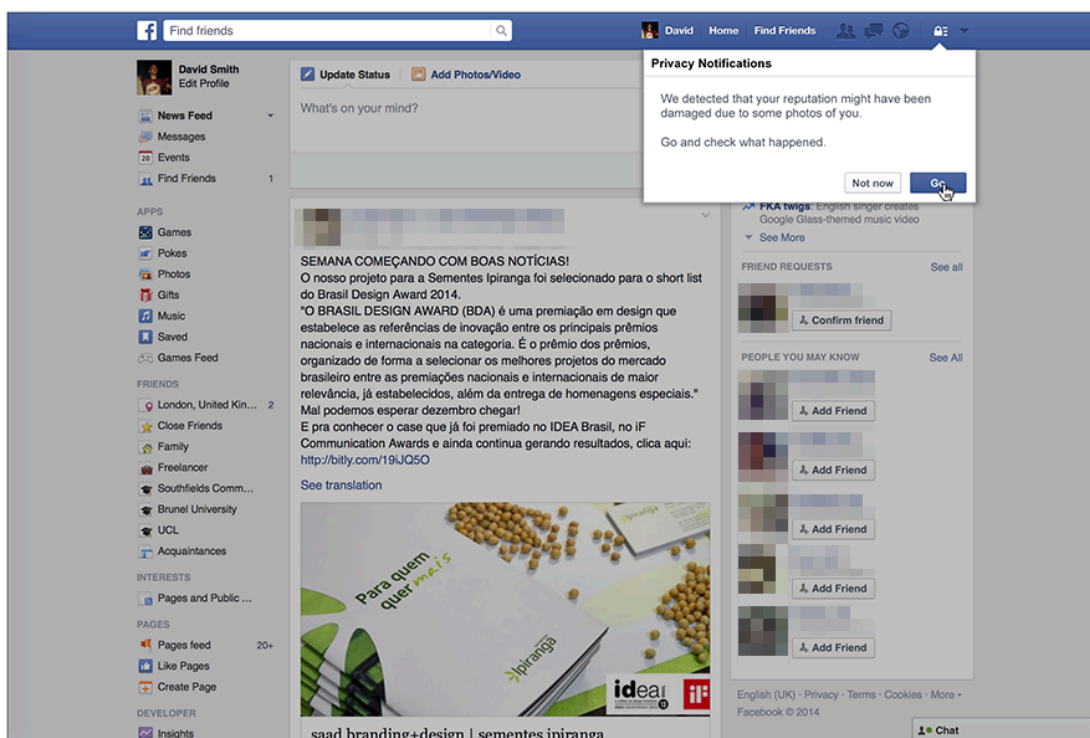


## Privacy Notification Popup

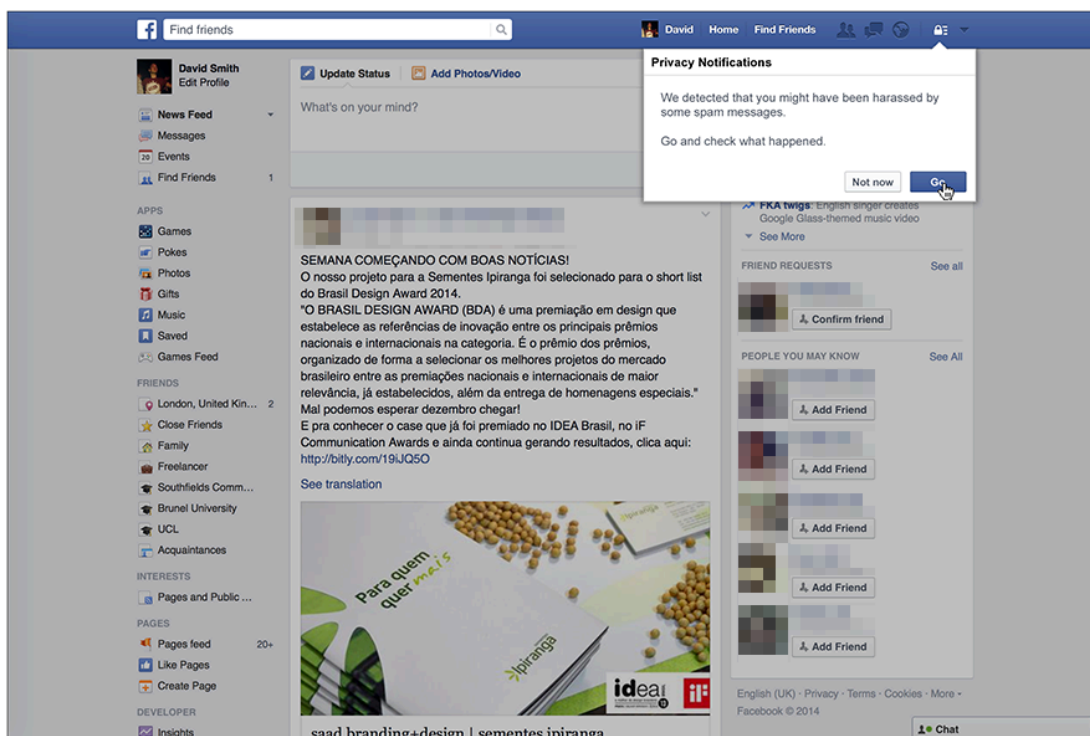
### Situation 1: Inadvertent Disclosure of Personal Information



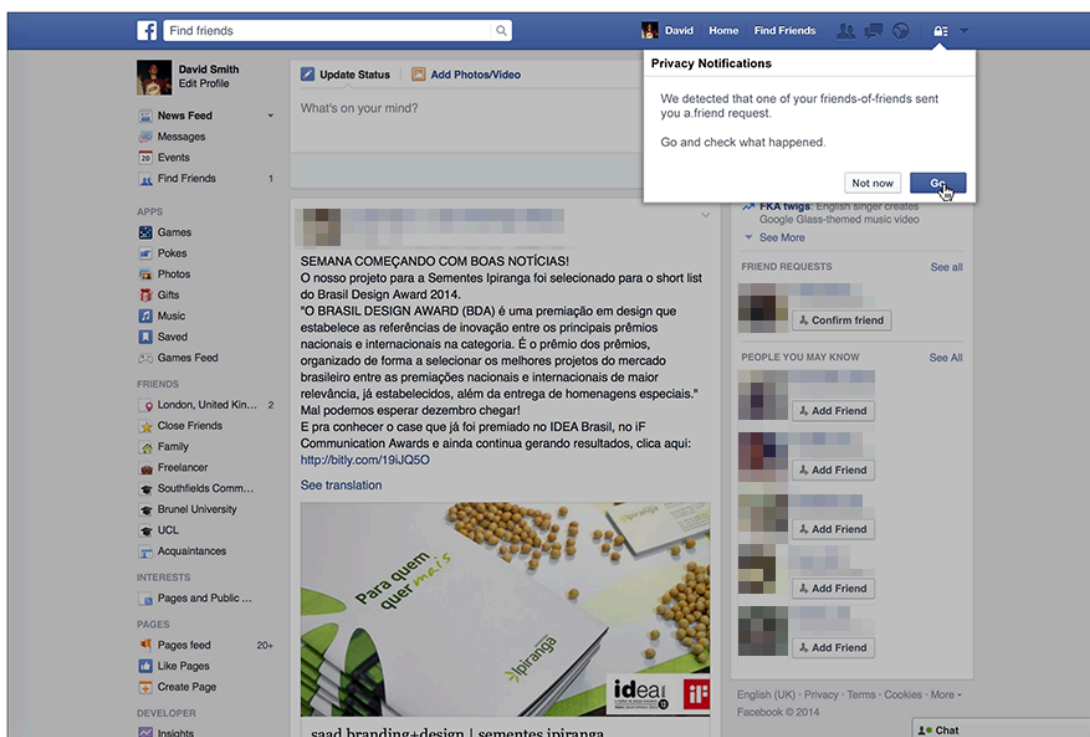
### Situation 2: Damaged Reputation Due to Rumours/Gossip



### Situation 3: Unwanted Contact and Harassment/Stalking



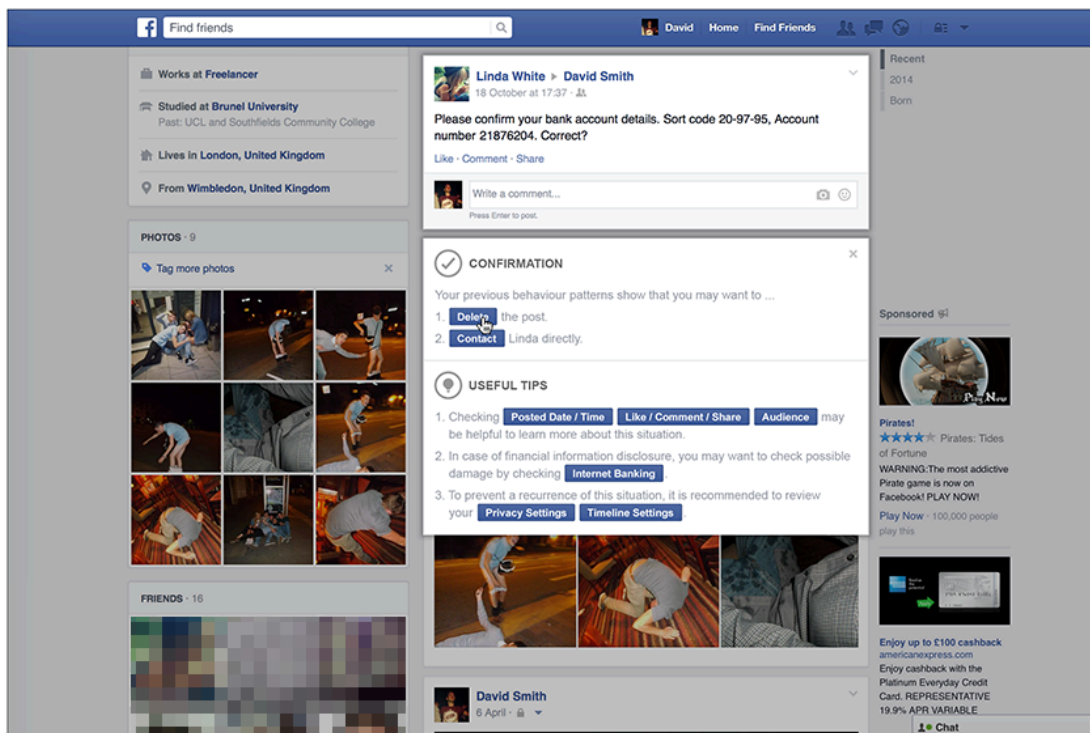
### Situation 4: Surveillance-like Structure



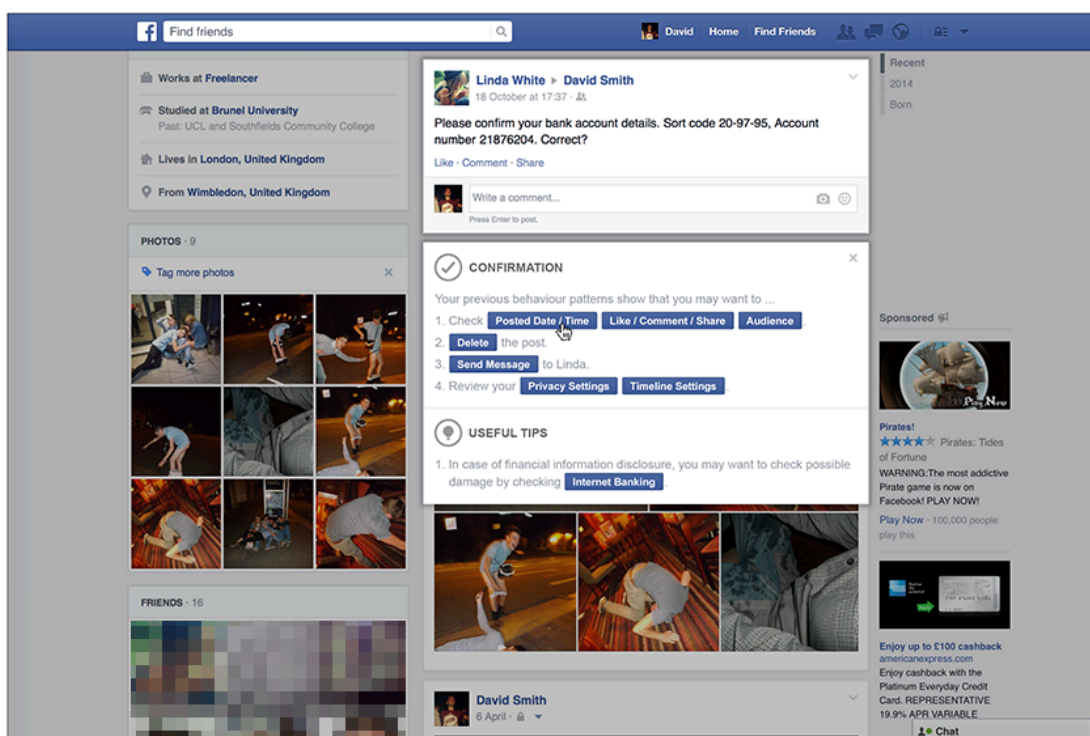
## C.2.3 User Type-Based Software Agent

### Situation 1: Inadvertent Disclosure of Personal Information

#### Uninformed

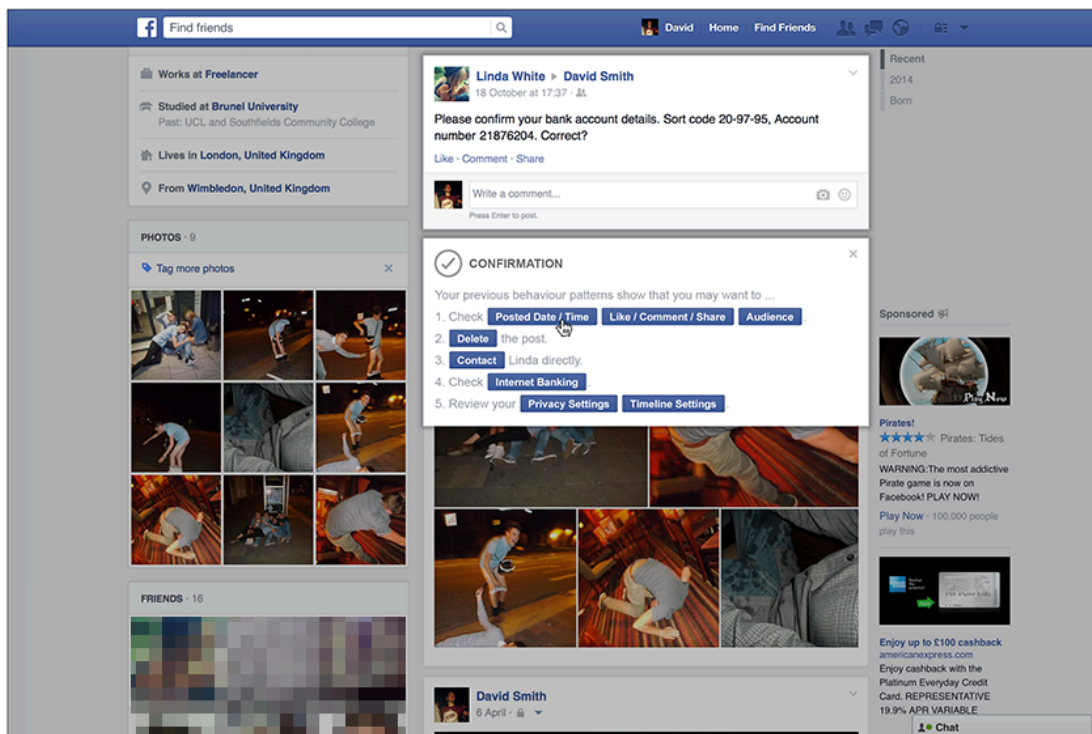


#### Trustful

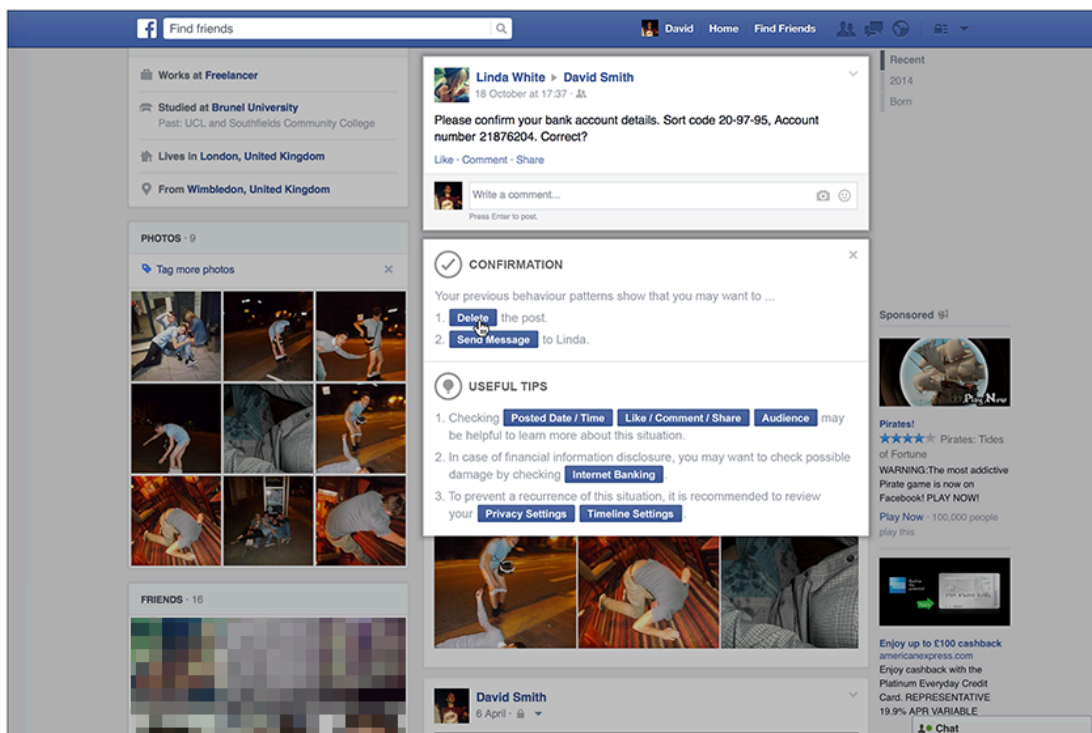




## Suspicious

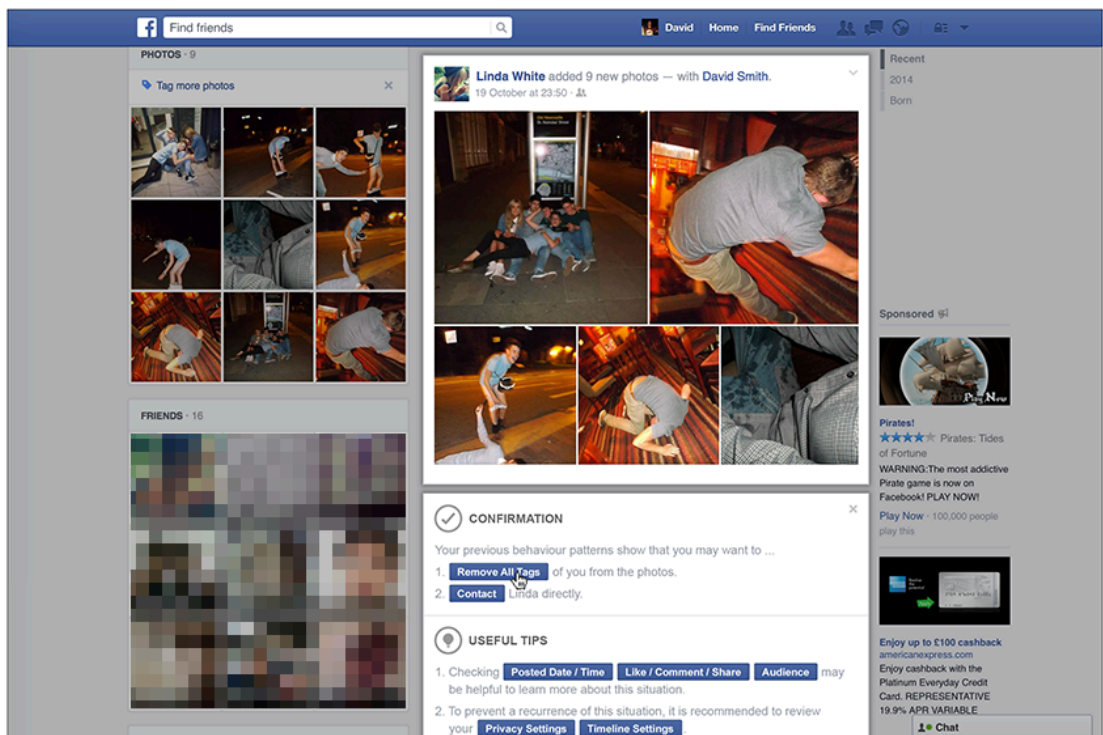


## Neglectful

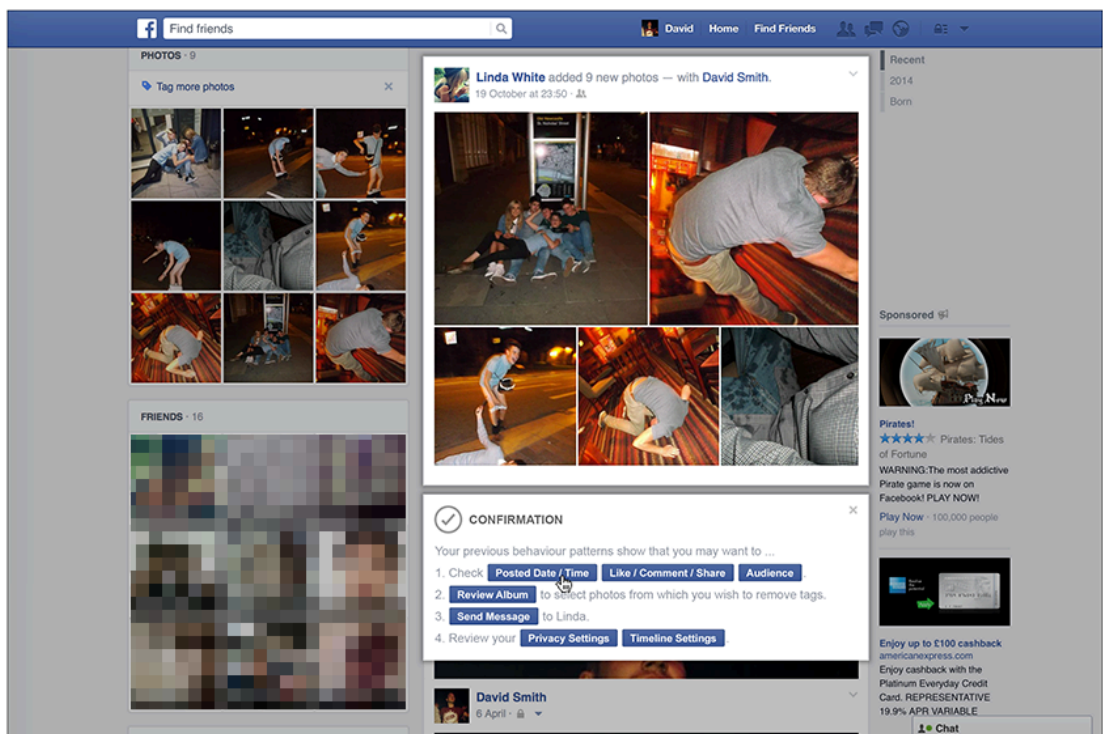


**Situation 2: Damages Reputation Due to Rumours/Gossip**

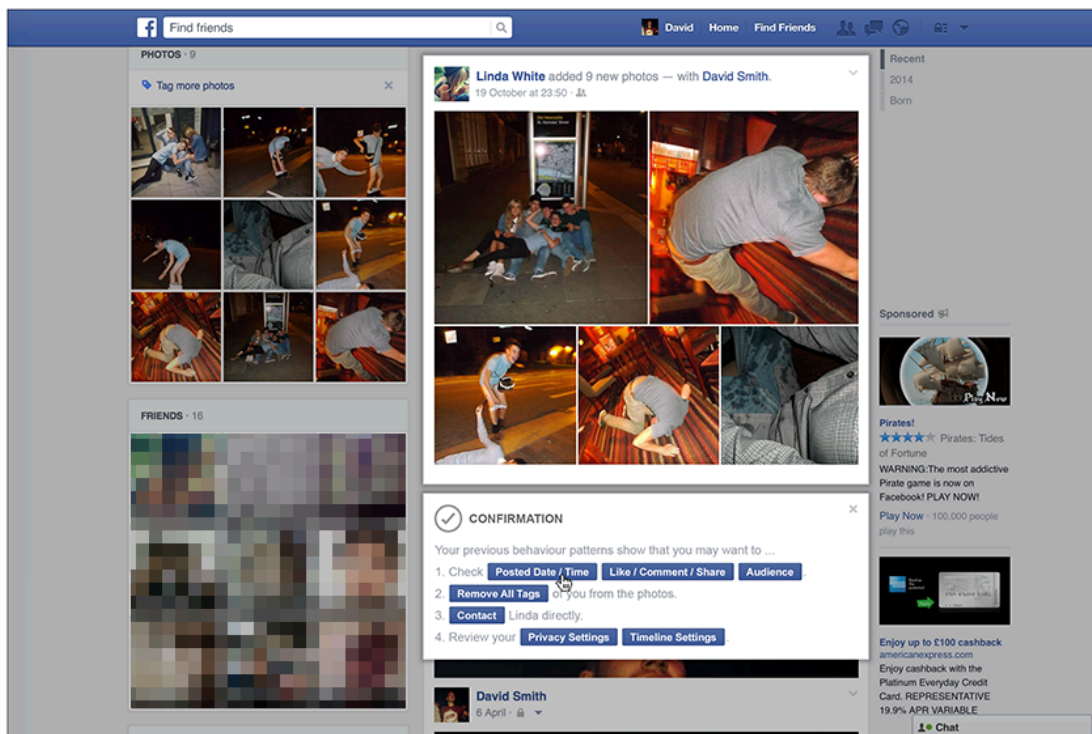
**Uninformed**



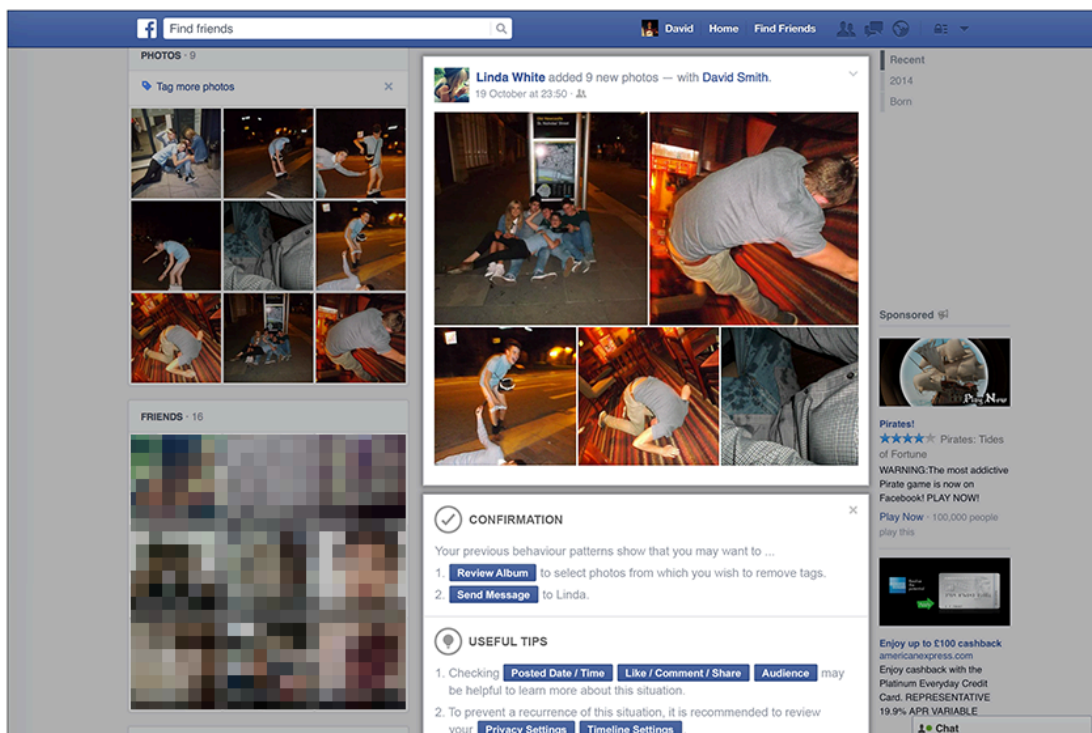
**Trustful**



## Suspicious

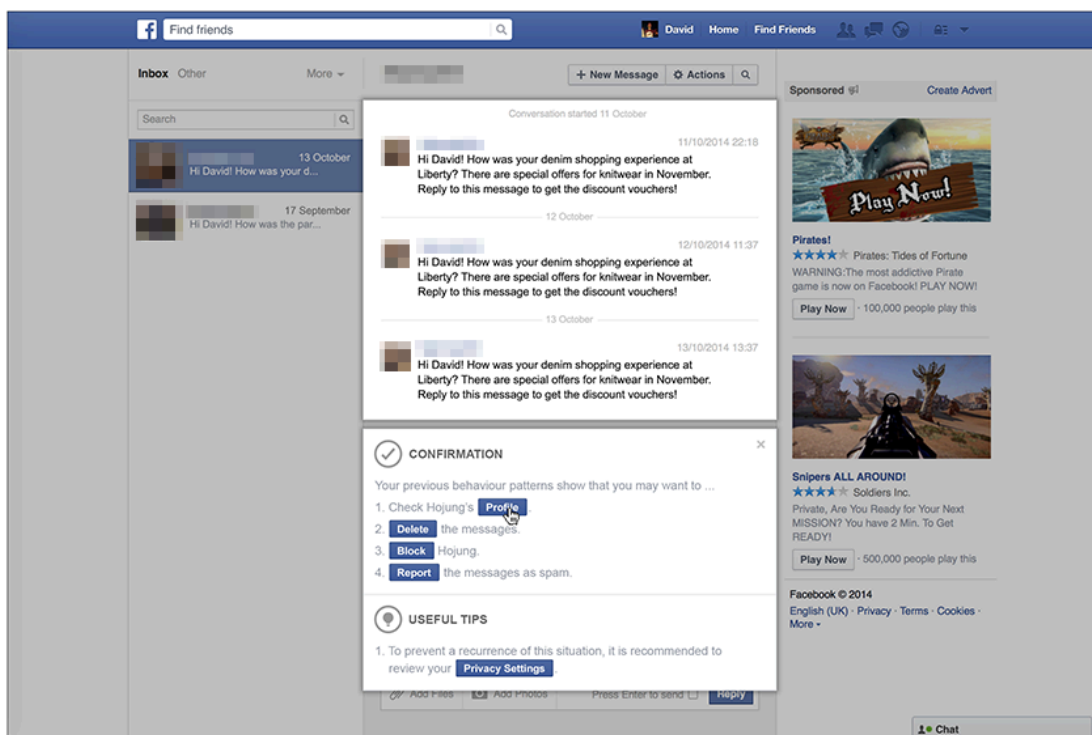


## Neglectful

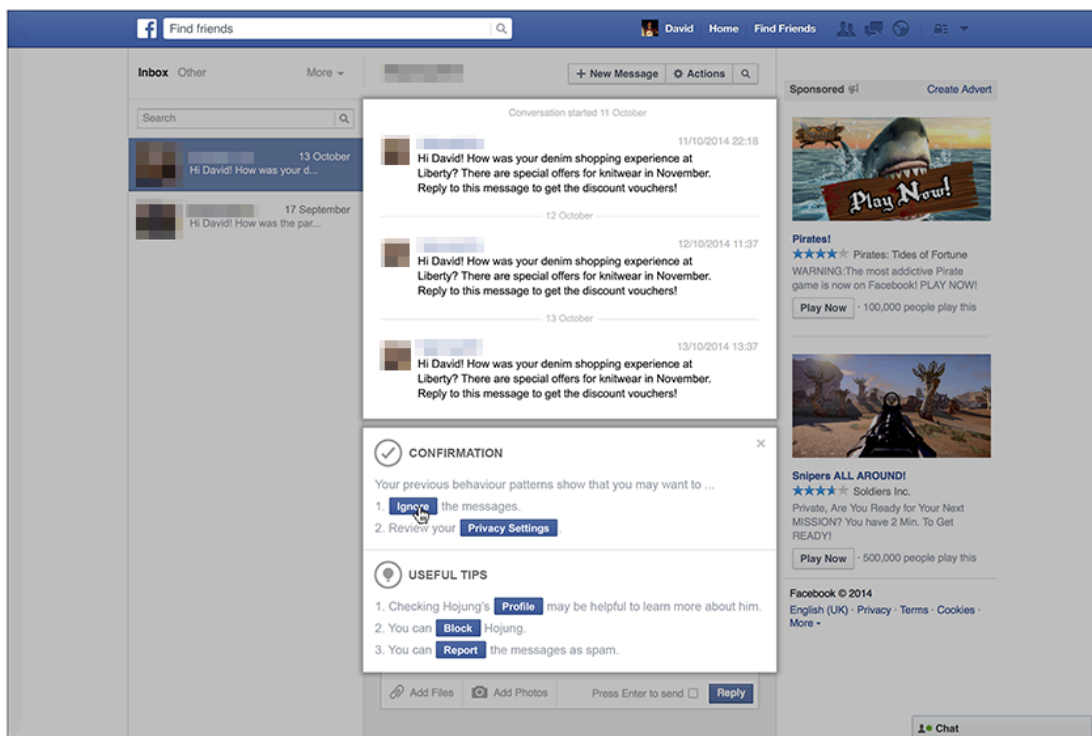


### Situation 3: Unwanted Contact and Harassment/Stalking

#### Uninformed

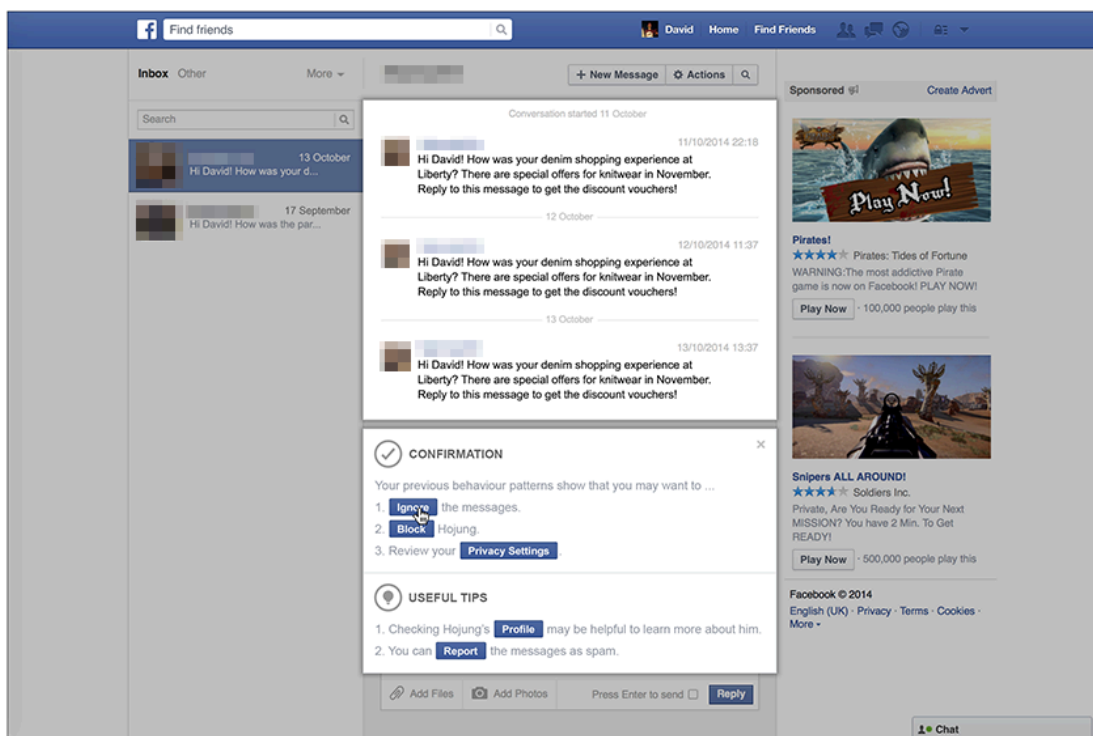


#### Trustful

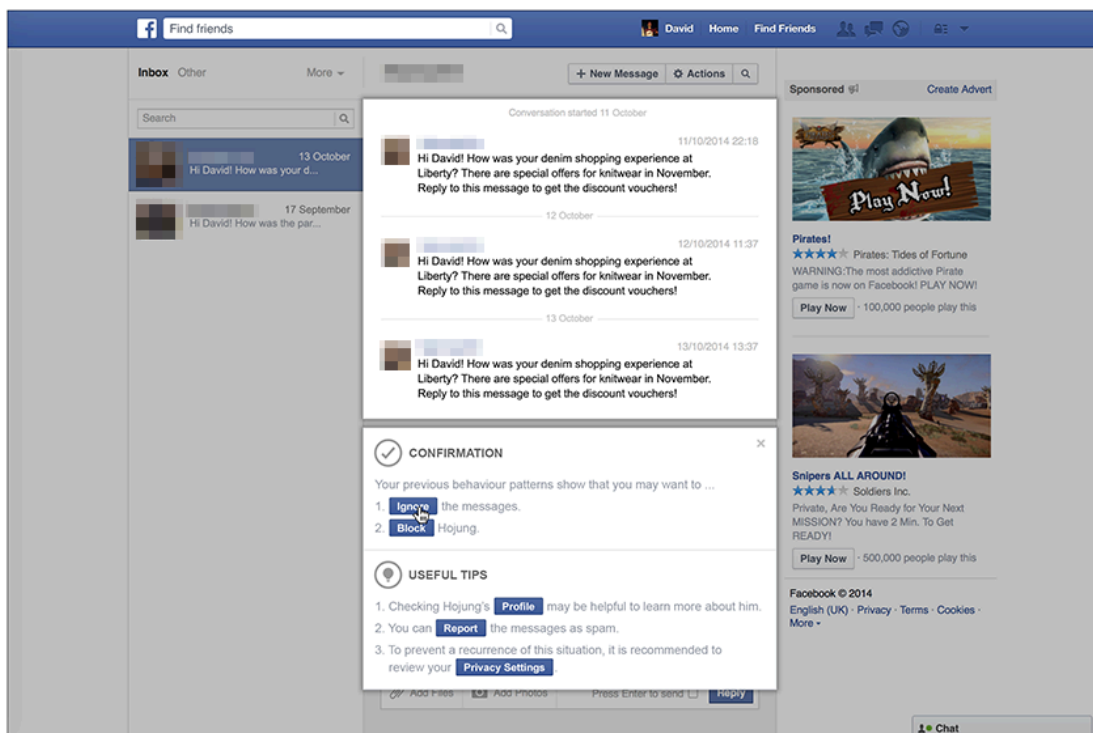




## Suspicious

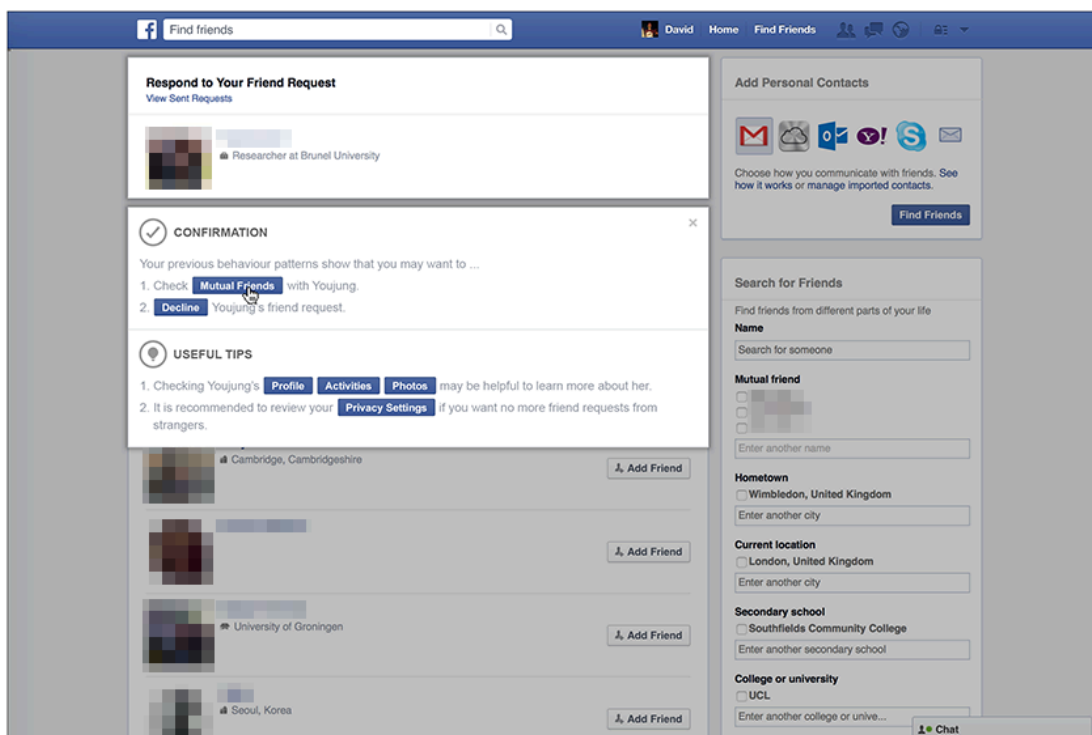


## Neglectful

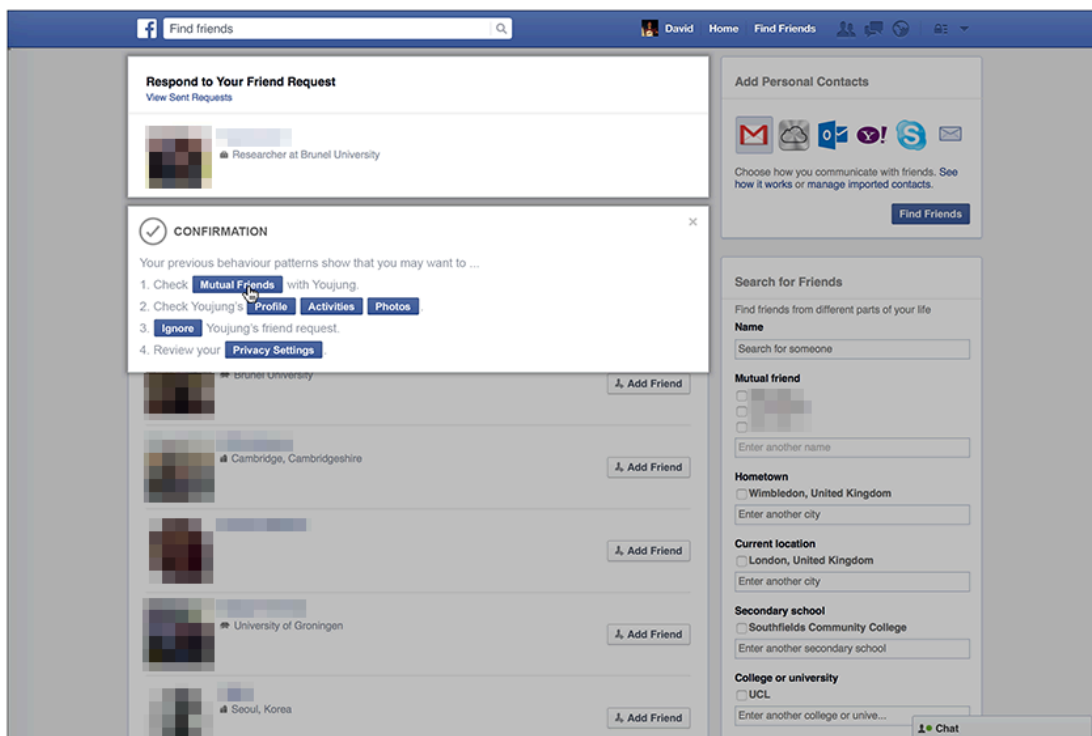


### Situation 4: Surveillance-like Structure

## Uninformed



## Trustful



## Suspicious

**Respond to Your Friend Request**  
View Sent Requests

Researcher at Brunel University

**CONFIRMATION**

Your previous behaviour patterns show that you may want to ...

1. Check [Mutual Friends](#) with Youjung.
2. [Ignore](#) Youjung's friend request.
3. Review your [Privacy Settings](#).

**USEFUL TIPS**

1. Checking Youjung's [Profile](#), [Activities](#), [Photos](#) may be helpful to learn more about her.

Cambridge, Cambridgeshire [Add Friend](#)

University of Groningen [Add Friend](#)

Seoul, Korea [Add Friend](#)

Add Personal Contacts

Search for Friends

Find friends from different parts of your life

**Name**

Search for someone

**Mutual friend**

Enter another name

**Hometown**

Wimbledon, United Kingdom

Enter another city

**Current location**

London, United Kingdom

Enter another city

**Secondary school**

Southfields Community College

Enter another secondary school

**College or university**

UCL

Enter another college or unive...

[Chat](#)

## Neglectful

**Respond to Your Friend Request**  
View Sent Requests

Researcher at Brunel University

**CONFIRMATION**

Your previous behaviour patterns show that you may want to ...

1. Check [Mutual Friends](#) with Youjung.
2. Check Youjung's [Profile](#), [Activities](#), [Photos](#).
3. [Ignore](#) Youjung's friend request.

**USEFUL TIPS**

1. It is recommended to review your [Privacy Settings](#) if you want no more friend requests from strangers.

Cambridge, Cambridgeshire [Add Friend](#)

University of Groningen [Add Friend](#)

Seoul, Korea [Add Friend](#)

Add Personal Contacts

Search for Friends

Find friends from different parts of your life

**Name**

Search for someone

**Mutual friend**

Enter another name

**Hometown**

Wimbledon, United Kingdom

Enter another city

**Current location**

London, United Kingdom

Enter another city

**Secondary school**

Southfields Community College

Enter another secondary school

**College or university**

UCL

Enter another college or unive...

[Chat](#)

## C.3 Cluster Analysis Replication

### C.3.1 Factor Analysis

KMO and Bartlett's Test

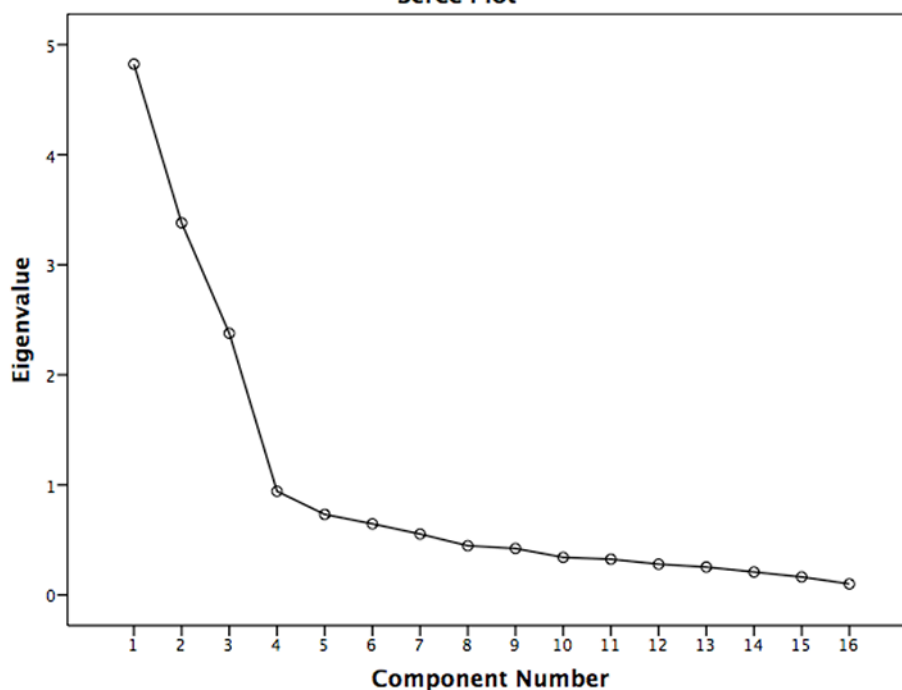
Kaiser–Meyer–Olkin Measure of Sampling Adequacy.		.799
Bartlett's Test of Sphericity	Approx. Chi-Square	1973.253
	df	120
Sig.		.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.823	30.147	30.147	4.823	30.147	30.147	4.259	26.620	26.620
2	3.381	21.131	51.278	3.381	21.131	51.278	3.825	23.908	50.528
3	2.378	14.860	66.138	2.378	14.860	66.138	2.498	15.610	66.138
4	.943	5.891	72.029						
5	.732	4.575	76.603						
6	.646	4.040	80.643						
7	.554	3.461	84.104						
8	.447	2.797	86.901						
9	.423	2.641	89.542						
10	.342	2.135	91.678						
11	.325	2.032	93.710						
12	.280	1.749	95.459						
13	.254	1.586	97.045						
14	.209	1.304	98.350						
15	.164	1.024	99.373						
16	.100	.627	100.000						

Extraction Method: Principal Component Analysis.

Scree Plot





### C.3.2 Reliability Analysis

#### *Privacy Awareness*

Item–Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Cronbach's Alpha if Item Deleted
PA1	20.6165	25.701	.781	.840
PA2	20.6214	25.241	.779	.839
PA3	20.6893	26.225	.581	.877
PA4	20.5340	25.909	.709	.852
PA5	20.5922	27.004	.730	.850
PA6	20.5146	29.061	.548	.877

Reliability Statistics

Cronbach's Alpha	N of Items
.877	6

#### *Trust/Carelessness*

Item–Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Cronbach's Alpha if Item Deleted
TC1	14.1893	23.325	.810	.892
TC2	13.9078	24.601	.711	.905
TC3	13.7427	24.407	.680	.910
TC4	13.3350	23.843	.713	.905
TC5	13.8883	22.812	.797	.893
TC6	14.2136	21.769	.846	.886

Reliability Statistics

Cronbach's Alpha	N of Items
.914	6

#### *Responsibility*

Item–Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Cronbach's Alpha if Item Deleted
R1	12.3738	7.406	.531	.763
R2	12.2670	7.553	.586	.737
R3	12.1699	6.483	.676	.687
R4	12.9660	7.135	.581	.738

Reliability Statistics

Cronbach's Alpha	N of Items
.785	4

## C.4 Key Emotional Responses: Normality Tests

### C.4.1 Situation 1: Inadvertent Disclosure of Personal Information

#### *Uninformed*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S1_N5_Diff	.190	35	.003	.861	35	.000
S1_N9_Diff	.223	35	.000	.929	35	.025
S1_N10_Diff	.175	35	.008	.896	35	.003

a. Lilliefors Significance Correction

#### *Trustful*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S1_N5_Diff	.148	78	.000	.937	78	.001

a. Lilliefors Significance Correction

#### *Suspicious*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S1_N5_Diff	.189	50	.000	.903	50	.001
S1_N6_Diff	.184	50	.000	.926	50	.004
S1_N9_Diff	.219	50	.000	.918	50	.002
S1_N10_Diff	.154	50	.005	.921	50	.003

a. Lilliefors Significance Correction

#### *Neglectful*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S1_N5_Diff	.176	43	.002	.910	43	.003
S1_N9_Diff	.228	43	.000	.916	43	.004

a. Lilliefors Significance Correction

## C.4.2 Situation 2: Damaged Reputation Due to Rumours/Gossip

### *Uninformed*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S2_N3_Diff	.235	35	.000	.876	35	.001
S2_N4_Diff	.190	35	.002	.897	35	.003
S2_N5_Diff	.241	35	.000	.902	35	.005
S2_N7_Diff	.190	35	.002	.927	35	.023
S2_N9_Diff	.228	35	.000	.915	35	.011
S2_N10_Diff	.285	35	.000	.865	35	.001

a. Lilliefors Significance Correction

### *Trustful*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S2_N4_Diff	.220	78	.000	.888	78	.000

a. Lilliefors Significance Correction

### *Suspicious*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S2_N1_Diff	.195	50	.000	.933	50	.007
S2_N2_Diff	.214	50	.000	.920	50	.002
S2_N3_Diff	.213	50	.000	.937	50	.010
S2_N4_Diff	.199	50	.000	.912	50	.001
S2_N5_Diff	.173	50	.001	.940	50	.014
S2_N7_Diff	.150	50	.006	.948	50	.029
S2_N9_Diff	.220	50	.000	.912	50	.001
S2_N10_Diff	.176	50	.000	.935	50	.008

a. Lilliefors Significance Correction

### *Neglectful*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S2_N3_Diff	.190	43	.000	.887	43	.001
S2_N4_Diff	.161	43	.007	.909	43	.002
S2_N5_Diff	.147	43	.020	.931	43	.013
S2_N9_Diff	.252	43	.000	.879	43	.000

a. Lilliefors Significance Correction

### C.4.3 Situation 3: Unwanted Contact and Harassment/Stalking

#### *Uninformed*

##### Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S3_N5_Diff	.244	35	.000	.894	35	.003
S3_N9_Diff	.288	35	.000	.815	35	.000
S3_N10_Diff	.173	35	.009	.927	35	.022

a. Lilliefors Significance Correction

#### *Trustful*

##### Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S3_N9_Diff	.205	78	.000	.897	78	.000

a. Lilliefors Significance Correction

#### *Suspicious*

##### Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S3_N9_Diff	.231	50	.000	.870	50	.000

a. Lilliefors Significance Correction

#### *Neglectful*

##### Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S3_N9_Diff	.225	43	.000	.860	43	.000

a. Lilliefors Significance Correction

### C.4.4 Situation 4: Surveillance-like Structure

#### *Uninformed*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S4_P1_Diff	.224	35	.000	.890	35	.002

a. Lilliefors Significance Correction

#### *Suspicious*

Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
S4_P1_Diff	.190	50	.000	.924	50	.003

a. Lilliefors Significance Correction