Research into attitudes concerning security and privacy when utilising geolocation technologies

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A dissertation submitted to the University of Dublin

in partial fulfilment of the requirements for the degree of

MSc in management of Information Systems

2nd September 2013

Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university. I further declare that this research has been carried out in full compliance with the ethical research requirements of the School of Computer science and Statistics

Signed_____

Sean Mc Adam

2nd Sept 2013

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I agree that the School of Computer Science and Statistics, Trinity College may lend or copy this dissertation upon request.

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2nd Sept 2013

Acknowledgements

To Assumpta and Tony, thank you for everything. I owe this to you.

To Laura. For the laughter.

Special thanks to Frank Bannister for tirelessly attempting to

translate my draft work into something more meaningful.

Abstract

Geolocation technologies are an embedded feature in many online social networks. They allow a user to “tag” themselves in a geographic location. This information is then displayed within the network to their peers and friends. This is a nascent technology that is showing explosive signs of growth and is already mainstream, soon to be a ubiquitous feature in all social networks. There are many areas surrounding these technologies that are unclear such as the legal status of the data and how it should be stored and handled.

There is much scope with the technology for data that has been shared in good faith to be misused. There is also little research into the how users regard these technologies particularly with respect to security and privacy concerns that arise from the potential misuse of data. This research aims to quantify attitudes toward geolocation technologies and also understand if there are significant factors that may predict the level of concern an individual may have, such as gender, parenthood and confidence with technology.

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1. Introduction

1.1 Introduction

This chapter aims to give context to the research. The research question and sub-questions are stated. It also deals with why this research is relevant and who stands to benefit from it. Finally it provides an outline of this document.

1.2 Context and Rationale of this research

With the ubiquity in modern life of ”smart” mobile devices capable of rich functionality, the feature that arguably transforms the computing paradigm is the geolocation function and location based services. A devices ability to be location aware in real time catapults it from being a simple communications device to a complex stream of live data. It can almost be considered a virtual avatar of the user, particularly if social networks are heavily used. Many applications access and utilise the location data produced by a device. These data are produced not only by location based services but also through triangulation data from 3G and WiFi connectivity. There are broadly two models driving location based services, each requiring different levels user interaction. One model is that of FourSquare in which the publication of data is private i.e. only to the application developers. The user checks into a location to receive benefits which are delivered through FourSquare. Conversely Facebook utilises a model where data sharing is predominantly driven by the user, for example publicly “Checking In” to a location in order to receive benefits. Checking In is a colloquialism for geo-tagging oneself or a group in any given physical location within a social network. This advertises their presence to any friends or contacts within the network in turn for rewards or simply to alert friends and others to their activities and whereabouts. This data is consensually shared to application developers, who may then pass the information to third parties.

To what end this data is used is murky and indeed can be difficult to ascertain exactly what data is being harvested. This data can be used to build a precise picture of user behaviour, particularly if coupled with other data streams from the device such as web browsing information or contactless payment functionality. Logically the next step for advertisers and developers is to build a prescriptive advertising model based on previous user habits coupled with hyper local services. For example, if a user frequents a particular chain of coffee shop, it will be possible for a rival chain to notify the subject in advance of them walking nearby to a branch of its own brand. Furthermore it is possible to inadvertently share ones location by posting photos online in popular services such as Flickr or Tumblr as photos taken on smart mobile devices embed the latitudinal and longitudinal coordinates in the images metadata. Once posted a photo can be downloaded and stripped of its metadata to reveal the location of the image and photo subject.

The cost of geolocation services to the end user is loss of privacy, whether explicitly allowed or not. But the potential upside benefits to users and particularly businesses or advertisers are huge. A long sought holy grail of marketers is highly personalised advertisements delivered directly to a (hopefully) receptive user. This removes the wasteful spending of current models on scattergun campaigns on television and print media. Historical geolocation data can be analysed in conjunction with other data streams from a device like NFC (Near Field Contact) payment data to ascertain optimum time and location of advertisement delivery.

In order to successfully harvest data efficiently and legally businesses must find ways to pass benefits to end users beyond simply having more relevant advertising delivered to them. This may be through delivery of special offers based on location and user habits. Another incentive could be a cash “rebate”, where the user effectively sells their data to a business that can pass the information both singularly and in aggregated form to third parties. It is currently not widely recognized that this information transaction is taking place, whereby the user is “crediting” a business with their data. For geolocation services to entice sceptics this transaction must balance (user receives benefit from business gaining insight into habits and locations) and business must find mechanisms to adequately and fairly reimburse the user.

While the rich functionality that location based services allow are extremely attractive for users, service providers and application developers there are significant risks and the potential for misappropriation of data is vast on a number of levels. As alluded to previously data ownership is opaque at best. To acquire the benefits of location based services a user will sign away rights to the usage and in some cases ownership of a copy of their data. There have been cases of user data being provided to unapproved third parties, and even in unanonymized format. This loss of privacy and ownership is unpalatable to many and according to corporate studies of consumers in the US is the single largest blocker to much more widespread user acceptance of geolocation services. Furthermore there are have been instances when location data shared in good faith has been misappropriated and used against the person who initially shared, for example burglaries taking place as a result of a user tweeting or sharing a status which indicated that they are away from their property or belongings for an extended period of time.

1.3 Research Question

The focus of this research is the

"Does parenthood have a significant bearing on an individual's attitude to online location sharing, and if so how does it affect their attitude?"

Sub questions that are relevant within this research are:

- Does attitude differ between parent and non-parents, and do they have different attitudes to minors using the technology?
- Does attitude differ between people who have Checked In and those that have not?
- Does respondent's age significantly alter their attitude and attitude to minors using Check Ins?
- Does gender cause a significant bias to the attitudes and attitude to minors using Check Ins?
- Does confidence and familiarity with smart devices influence how people consider these technologies?

1.4 Why is this research relevant and who may benefit from it?

There is little research currently available into the attitudes of Irish consumers relating to the concerns (or lack of) arising from location based services and the inherent loss of privacy that is a consequence of these services. Online location sharing technologies are nascent and the delineation between each generation's attitudes is as yet little understood. This research seeks to provide a snapshot measurement of attitudes. It also seeks to understand whether factors like gender and age or significant life events such as parenthood have any bearing on an individual's attitude with respect to these technologies.

This research is pertinent to developers of applications and social networks. As developers seek to attract users to their services and platforms an understanding of their prospective customers will allow them to better design security features to appease varying cross-sections of their user base. Legislators may be interested in this research as a loose means of gauging public opinion to these technologies, possibly with a view as to legislating a minimum age as a requirement for these functions in social networks. Finally academics involved in researching social networks and location based services may find this study informative.

1.5 Dissertation Roadmap

The structure of this dissertation is as follows:

Chapter 1 considers background information on thesis and provides some context to the research. The research question is stated along with the scope of the study. A roadmap of the dissertation is also included.

Chapter 2 reviews literature that was deemed relevant to this research. Topics that were discussed include social networks, the concept of privacy and privacy concerns relating to online social networks, some of the legal issues surrounding online data protection and research into online location sharing.

Chapter 3 is a brief summary of research methodologies. It discusses their strengths and weaknesses and highlights why a particular methodology was chosen for this research. It also covers the structure of the data collection methods and how data collection was conducted.

Chapter 4 focuses on analysis of the data that was collected during the research and uses statistical analysis to answer the research question and sub questions.

Chapter 5 concludes the research by summarising the findings and points to areas where further research in this area could be undertaken.

2. Literature Review

2.1 Introduction

There are many seemingly disparate areas of research that relate to user disclosure in location based social networks, spanning issues defining the device a user will access a service on to the issues of privacy and control that surround information disclosure. This review will examines previous and current research relating to social networks, geolocation technologies and their functionality when embedded within a social network. It also covers some of the issues that surround these technologies such as privacy, trust, legal points and security concerns.

2.2 Social Networks

Much research has been completed on the area of Social Network Services (SNS).An early analysis (Lada et al, 2003) concluded that online social networks provide a dense representation of a user's social fabric due to a requirement to explicitly link to other user's profile pages. A definition of an online social network as described by boyd et al (2007, Pg 1) is as follows

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

Karl Marx claimed that

"society is not merely an aggregate of individuals; it is the sum of relations in which these individuals stand to one another"

These quotes taken in conjunction can be seen as descriptive of the basis for all online social networks. Social networks aim to recreate the links of real relationships and channel users communications and interactions through their portals as per boyd's quote. These relationships can then be aggregated as meta-data. Online social networks utilise this information (metadata) in an effort to make their content more relevant and to recreate the real-world in a user's online profile. Thus creating a kind of feedback loop – the more relevant online life is to real life the more time and effort the user will spend cultivating it.

2.3 Location based services within social networks

Junglas et al (2008) make reference to location based services (LBS) having long been touted as being the potential “Killer App” of e- and m-commerce. Location based services potentially provide location aware content to a user in real time, for example advertising a particular brand of coffee shop on a users mobile device as they pass in the vicinity of a branch of that chain. Junglas et al (2008, Pg 66) define LBS:

“*Location-based services are any service that takes into account the geographic location of an entity.”*

This is sufficient as a basic description. A more nuanced definition would have reference to a transaction between two entities, either software or human. The transaction is the sharing of information. A request is made for information either by or on behalf of a human user. This request is sent to an information provider, for example a social network. In order to fulfil the transaction the information provider requires precise geological data. This requested from the user who may comply tacitly or have software settings that allow this to happen automatically. On receipt of this data the information provider returns the requested information to the user, while also retaining the location data in order to build a more complete profile of the user. This definition would make allowance for a software-based request on behalf of or for the purpose of informing a human. Bernardos et al (2007) designed a framework with which to characterize location-based services. Their framework contains components such as

- the user requiring a GPS device
- content delivery
- privacy requirements
- commercialization channels

All of which are also relevant to location based social networks.

The meshing of Social Network Services and Location Based Services results in what is known in previous research as a Location Based Social Network (LBSN). This term is an umbrella for a broad number of services that provide LBSN functionality to some extent – examples of such services include Facebook Places, FourSquare, Gowalla, Twitter and BrightKite. A 2012 study by the Pew Internet and American Life project discovered that 74% of users of smart phones have at some time utilised live location based data and 18% have used an LBSN to reveal or “check in” their location. Bhanerjee et al (2008) found that advertising delivered in a location aware context and a timely manner can have a significant effect on the purchasing behaviour of users. Furthermore Ying et al (2012) and Meng et al

(2012) developed methods whereby through mining a user's previous behaviours it is possible to predict future behaviours and provide recommendations and/or advertisements that are both timely and relevant to a user. These studies indicate that location based services are likely to become more prevalent with the development of mobile technologies.

2.4 Why do people share location?

The act of online location sharing has been described as falling into 2 categories (Tang et al, 2010) with significantly different purposes. Tang makes the distinction between the two with what she terms social-driven location sharing, with purpose-driven sharing being the other type. Social capital is the base reason for social-driven sharing. The type of sharing which occurs can influence sharing decisions, privacy strategies and amount of information disclosed. Typically purpose-driven sharing occurs on a one-to-one basis, and social-sharing on a one-to-many basis. However the sample group was small, consisting of 9 students which may bring into question the validity of its findings. Another issue with the methodology in this study is that users were given a specific mobile phone to carry for the duration. This places an onus to share on the subject that may not accurately reflect their real-world behaviour within an LBSN. Regarding the findings of this paper establishing a classification of different types of sharing is significant as these appear to be the building blocks on which users base their privacy strategies.

Furthermore some work has been done in the area of identifying broad models that "location sharers" fall into (Toch et al, 2010) however a criticism of this study is that it was conducted in a closed social network that was created specifically for the purpose of this experiment and as such may not accurately reflect real world behaviour. This study examined the frequency of user check-ins in various locations. Locations were then classed as high or low entropy (i.e. frequently visited by all users or irregularly visited). Locations of high entropy were found to be more frequently checked into. This indicates that in privacy terms, users were more likely to publish their location from a place which was well known and did not reveal ancillary information about them beyond their whereabouts. But this view also confirms the findings in Tang et als finding, in so far as checking in to a well-known area could also be viewed as an attempt to gain social capital with their peer group.

Consolvo et al (2005) completed some of the first published studies on the motivational factors behind user-driven location sharing. Much of the testing in this study is speculative, i.e. the user was asked how they think they may share in a future scenario without ever having had access to the sharing tools that are now freely available and commonplace. The sharing as embodied in this study could also be considered purpose-driven, or one-to-one. As such it does not provide much information for the one-to-many model that is prevalent in LBSNs. However a conclusion of this study that is worth considering is that Consolvo feels that users want to either “disclose what they think would be useful to the requestor, or deny the request”(Pg 9). This suggests an element of bias may occur in disclosure.

Wiese et al (2011) established that of all the social factors that could influence sharing between two recipients, frequency of communication was the most likely to point towards further transactions occurring. This was followed by actual physical proximity. The supposition that follows is that frequency of communication is a stronger indicator of closeness of relationship than physical proximity. One of the recommendations of this study was to automate predictions for location sharing preferences within an LBSN. This is a worthwhile consideration for integration into LBSNs in the future as the current buddy-list model provides little granularity for refinement within sharing. These filters would restrict access to user profile and location information. In practise this would mean that software filters will automatically relax when there is a high volume of transactions between users. Conversely a low number of transactions would cause the filter to close. This refinement would be an improvement on current privacy settings which tend to only have low granularity settings – For example Facebook defines uses in a group called Friends – there is no further granularity of restriction. If any user in the Friend group is allowed to access profile information then all users in the Friends group have access irrespective of frequency of communication or any other indicators of closeness of relationship.

2.5 Concerns associates with location sharing in social networks

LBS and LBSN share the same issues in relation to user disclosure of location information. These issues impact on a range of topics including legal concerns and ethical issues. Peruso et al (2006) discussed some of these issues while LBS were in infancy and widespread adoption was not yet a reality. They concluded that legal processes and guidelines were not yet in place at that time to deal with the advent of the services, and that the main concerns surrounding these services can be described under the headings of: Privacy, Control, Security and Trust. Obviously the legal element has changed in the intervening seven years since Peruso's paper was published but the core concerns have not changed and continue to evolve.

2.5.1 Privacy

Privacy is a very broad issue that has ethical connotations. It is a concept that comes from human psychology. Margulies,(2003) compares and contrasts both Westin and Altman's theories of privacy. Both theorists share the opinion that privacy is to some degree a controllable concept (we may attempt to achieve privacy but may not completely realise our aim), however Westin's theories focus on information privacy which lends itself well to the nature of the discussion of LBSNs. A succinct definition of privacy comes from Westin's earlier work

"*The ability of the individual to control the terms under which personal information is acquired and used*."(Westin, 1970, Pg 7.).

Gurau et al (2009) undertook a geographically wide-ranging study on privacy concerns and perceptions with participants spanning three member countries of the European Union. While not specifically focusing on LBSNs this study is relevant as it refers to usage of location data in the context of mobile commerce. The research shows that users have developed privacy protection strategies of their own accord and that these strategies and the concerns they are founded upon are similar within national borders .For example: a concern in England would be repeated across the national population of the study irrespective of rural or urban location, but would not necessarily be considered an issue by respondents in France. The study also shows that there is a large variation in the level of concern with regard to privacy depending on age, gender and intensity of mobile phone usage. User concerns are broadly in line with expectations, in that very young and very old users have little knowledge of legislation or legal protection, and users that are significantly more active in mobile phone usage are more likely to share location data. The findings of this study are

instructive in that they show users are likely to develop methods of protecting their privacy in response to their own perceived threats. It is interesting to also note that user concerns are bounded more strongly by nationality than by age group – a young urban French male (18-25 years old) will have concerns more in common with a older French female respondent than with a young urban male from the United Kingdom. This suggests that the concept of online privacy is heavily influenced by national cultures.

2.5.2 Control (Legal)

The legal frameworks that address LBS and LBSN purport to achieve some control and oversight mechanisms. Tama (2012) advises on several legal committees at work in the US and their areas of focus. Costa et al (2012) outlines many of the changes that are occurring in European law as a result of the re-writing of Directive 95/46/EC (Data Protection Directive). Imperiali (2012) makes recommendations that companies and data-controllers should move their corporate culture from one of simple compliance to a more deeply ingrained policy of continuous vigilance with respect to data security. He also advises having dedicated "control rooms" to deal specifically with compliance in this regard. This is very relevant as with time more and more user data is stored by LBSNs As yet there are no frameworks standards (along the lines if ISO for example) to which the LBSNs must adhere will evolve. Imperiali's research is an early step in this direction.

"Geo-location data" has been adjudged by the Article 29 Working party to fall into the category of "personal data" and as such falls under the auspices of the Data Protection Directive. However there have been no cases or studies done to verify this in practise. Furthermore the Data Protection Directive is to be superseded in the near future (see: Proposal for General Data Protection Regulation in references). De Hert et al (2012) outline the main areas that legislation is to be improved, but their remit was with regards to personal data. As such they do not refer specifically to mobile location data.

Another concern in this area is that users are not cognisant of any broadcast of location that may occur on their behalf. Users of LBSNs should be obliged to ensure that they are aware of the controls that are available to them within a system to prevent their data being available to unsolicited entities. This may seem trivial but is important for a user's safety. Crimes are purported to have been committed on the basis of location information posted in LBSNs, and in the USA mobile phone companies have been compelled without warrant by law enforcement agencies to turn over mobile and GPS data to trace user's movements.

2.5.3 Security

Patil et al (2012) conducted their study on user privacy considerations in a broad range of location based services. A notable finding is that most users are more comfortable revealing location when the location based service is embedded in a broader system (for example Facebook Places).Although not explicit in the results, this would suggest that users are more comfortable revealing location data to a "buddy-list" of followers – fellow user that have been pre-approved. An interesting finding of this research is that many respondents (25%) have expressed regret about location disclosure. Not regret to the actual act of sharing, but as a result of the user misaligning the recipient audience with the theme intended. If for example a young male were to make lewd or lascivious remarks regarding a female peer, and these comments were viewed by an older female family relative who take offence. This points to an ill-advised privacy strategy at best, at worst a total lack of strategy on the part of the user. Over 20% of respondents experience regret as a result of being caught lying when revealing location – Patil suggest that this could be resolved by a conflict detection system within a device or software system, however it may be beneficial to actually allow deliberate misinformation within an LBSN if the system is to evolve and accurately reflect realistic scenarios. The base point here is that lying will always exist in the "real world" and an attempt to have a conflict detection system inbuilt with a software system conjoined with hardware device could result in a breach of civil liberties. People are entitled to lie if they so desire, even if it is morally unprincipled to do so (this obviously disregards lying in the legal sense).

Page et al (2012) conducted a very small scale study (21 respondents) to try to establish a theory that social boundary preservation (colloquially known as a "comfort zone") was the root of many location sharing concerns. Their results showed that this was the most accurate explanation of concerns across all respondents. Frequent social media users were adjudged to have less concern with regard to sharing. Resultantly they were less likely to be concerned with their online social boundaries. Page feels confident enough to rule out any other influences (age, race, gender etc) in relation to these sharing concerns. However the credibility of any findings based on such a small and unrepresentative sample is questionable. At best these results are suggestive. Page et al (2013) further researches the basis for lying in location sharing social media. They acknowledge that lying is an everyday occurrence utilised to maintain the boundaries within relationship by smoothing personal interactions. This is not to say that people are pre-disposed to lying, but that in the course of social interaction it may be necessary to lie in the face of a perceived threat to their social

boundary. Interestingly the respondents here show an inverse relationship to the expected behaviours – users that exhibit a propensity to lie more frequently are also more likely to question the veracity of others location sharing data. It also has the nasty side-effect of backfiring on its intended purpose. A user who lies in the online world becomes more concerned about being caught in a lie, as there is a verifiable trail of data that could point to their real behaviour (notwithstanding any efforts to extend their untruth into the digital domain by having a co-conspirator carry their device to falsify their location).

Zhao et al (2012) examine how justice theory has been used with relation to privacy literature, and how it the perception of fairness has an impact on their decision to disclose personal data. They posit that a user completes a cost-benefit analysis prior to any location disclosure on the grounds of perceived fairness (of outcomes, policies and procedures and of interpersonal treatments). This work holds significant promise, but unfortunately the study and all respondents were resident in China. As a result of large scale government intervention and snooping in online media in China any user actions may be influenced by the perception that the government may be using the technology to spy on citizens. However they do acknowledge and expand upon the concept of "second-exchange"- users of LBSNs receiving benefits (monetary or otherwise) in exchange for data disclosure. The most important benefit is the personalization of content delivered back to the user.

2.5.4 Trust

Security and veracity of the data provided by a user to a LBSN is intrinsic to fulfilling the obligations required by the provider of the service. He et al (2011) outline difficulties that the social network Foursquare experienced with users "faking" their location by simply falsely checking into location in which they were not present. This represents a problem because Foursquare offers financial rewards to users when they check in multiple times at commercial locations (not to mention moral hazard). Foursquare had adopted a mechanism to combat this by verifying the user's location against a GPS system contained in the user's mobile device. Zhang et al (2012) also discuss possible methods to alleviate data security challenges. These are predominantly technical concerns and can take a number of forms. One problem is the verification of location data as published to be true. Fake user location data would compromise the integrity of a social network and if widespread would result in a loss of trust in the service provider.

In LBSNs trust relates to the relationships that users of social networks have with each other, and the effect that online interactions have on real world relations. LBSNs allow an individual much easier access to insight of the behaviours and movements of other users than would normally be possible without resorting to physical surveillance or significant research. It is possible to conduct surveillance on a subject though a social network if the user utilises geolocation services. This assumes that the sharing relationship has been validated by both parties i.e. User A has confirmed that they know User B and is happy to let them peruse their information. LBSNs have shown to have a significant negative impact on trust in relationships (Fusco et al, 2012). A flaw of this study is that the research was derived from focus groups of students. Although the subjects were not necessarily of typical student age the demographic leaned largely towards 18-25. As such there could be bias in perception due to the relevant youth of the study group.

2.6 Conclusion

This literature review has aimed to draw together some of the research that relates to the field of location services within social networks, with a particular focus on some of the ethical, moral and technological dilemmas that are prevalent. These concerns (specifically privacy, security and trust) inform the attitude of a user towards geo-location technologies.

3. Methodologies: Considered and Chosen

3.1 Research Methodologies Considered

There are many factors which may influence how a piece of research is carried out. Within IS and social sciences there are differing views as to what research is and how it can be carried out. There are frameworks that aim to hold researchers to a standard and guide their actions. These frameworks are research paradigms. They can be characterized as containing three main components: Ontology (What is reality?), Epistemology (What is my relationship to the knowledge I seek?) and Methodology (How to find out?) (Guba, 1990). The most common research paradigms in IS research are positivism and interpretivism. These paradigms shall be considered and the most suitable will be selected for this research.

The positivist paradigm asserts that "the social world can be studied in the same way as the natural world, that there is a method for studying the social world that is value free, and that explanations of a causal nature can be provided" (Mertens, 2005, p.8). Core to this paradigm is the ontological belief that reality exists independent of its observers and participants. The behaviour of people can be measured and quantified, and if the research is free of bias these measurements can be considered scientific knowledge. Analysis in the positivist paradigm tends to be statistical, mathematical and focuses on finding trends with a sample population and relationships between social phenomena (Morgan, 1983). Its strengths lie in the rigorous standards that the paradigm requests adherence to. A weakness of this philosophy is its claim to have scientific certainty when measuring human behaviours and elusive concepts.

Where positivism will often view populations at a macro level, interpretivism is focused on the micro level, or in other words the individual. Mertens says that “reality is socially constructed” (Mertens, 2005, pg.12). Interpretivist research seeks to explore and explain reality as viewed by the subject (Gephart, 1999). The belief that each subject has their own individual reality is intrinsic to the paradigm. By observing and interacting with a subject it is possible for a researcher to attempt to record the social phenomena that the subject considers to be important, and to understand the meaning that a subject attaches to these phenomena. This paradigm considers the social world a creation of the human mind. As a result it is different to the natural world and scientific methodologies are considered unsuitable. The paradigm endeavours to identify and explain phenomena through the meanings that people attach to them (Deetz, 2005). One of the strengths of interpretivist

research is that is has the ability to deeply explore and understand a viewpoint at a level not possible to a positivist. Conversely its weakness is that studies tend to be small and focus on the individual and as a result the scope of the research can be limited.

There are two different types of data; qualitative and quantitative. Qualitative data collection methods focus on the richness of the data. These methods include questionnaires, interviews and also case studies, document and image analysis and video recordings. Typically qualitative data is non-numerical, descriptive and can consist of words, images and audio (Symonds, 2008). From this data the researcher hopes to derive understanding of the subject's viewpoint and their perception of what they deem to be reality. Qualitative samples are frequently small and sometimes single scale (case studies) (Creswell, 2007). A criticism of this type of data collection is that as the researcher is an active part of the research it can lead to claims that data may be bias.

Quantitative data is primarily concerned with empirical measurements coupled with statistical analysis. Quantitative data collection tools are structured, some of which include questionnaires, interviews, systematic observations and official statistics. (Symonds, 2008) Quantitative sample sizes tend to be larger than qualitative samples. Quantitative data analysis can be criticized for lacking the tools to deeply understand motivational factors of respondents (Stokes & Urquhart, 2013)

3.2 Chosen Methodology

The research question in this piece of research asks whether a significant life event (parenthood) has an impact on a respondent's attitude towards a minor's usage of geo-tagging technologies. There are two significant reasons why the positivist paradigm in conjunction with quantitative data collection methods were chosen for this research. The first is philosophical: the aim of positivism is to observe and quantitatively measure social phenomena as objectively as possible. This is precisely the aim of this research. A positivistic philosophy is assumed for this research as the impossibility of completely separating the researcher from the subject matter is recognized. This paradigm was selected as it is conventional, suitable for the nature of the research question and practical to execute. One of the flaws of this paradigm is that it lacks the ability to deeply question the individual's motivations and concerns with regard to the technologies. This study is exploratory in nature and as such seeks to establish a trend within the sample population.

Quantitative methods (in this case a survey) are used for data collection as they will provide statistical robustness to the findings. It is to be noted that the data collection method that has been selected (online survey) is not without its own set of strengths and weaknesses. Initial set up costs are low and delivery to a large sample population is straightforward, however as previously noted the fixed nature of the survey being used does lack the ability to probe into the responses on a case by case basis.

3.3 Research and Survey Design

The data collection method for this research is a survey. The survey was delivered online using Surveymonkey. Benefits of using an online survey include:

- Ease of delivery to respondent
- Control of format
- Data is easily transposed into data analysis tools (for example SPSS)

The initial phase of the design process involved identifying all the variables and constructs.

3.3.1 Variables

- Age of respondent (banded)
- Gender of respondent
- Have the respondents used Check Ins?
- Parental Status
- Number of children
- Age of child 1/2/3 (banded)
- Gender of child 1/2/3 etc

These variables are characteristics of the object that can be used as a factor for differentiation when analyzing survey results. All can be answered with either a dichotomous choice (Gender/Parental/Ever Checked In?), an ordinal value (Number of children) or an interval scale (Age of respondent/Age of child/ Gender of child).

3.3.2 Constructs

There are three constructs namely respondent's

- familiarity with technology
- attitude towards security and privacy relating to online location sharing
- attitude towards security and privacy relating to a minor's online location sharing

Construct Validity

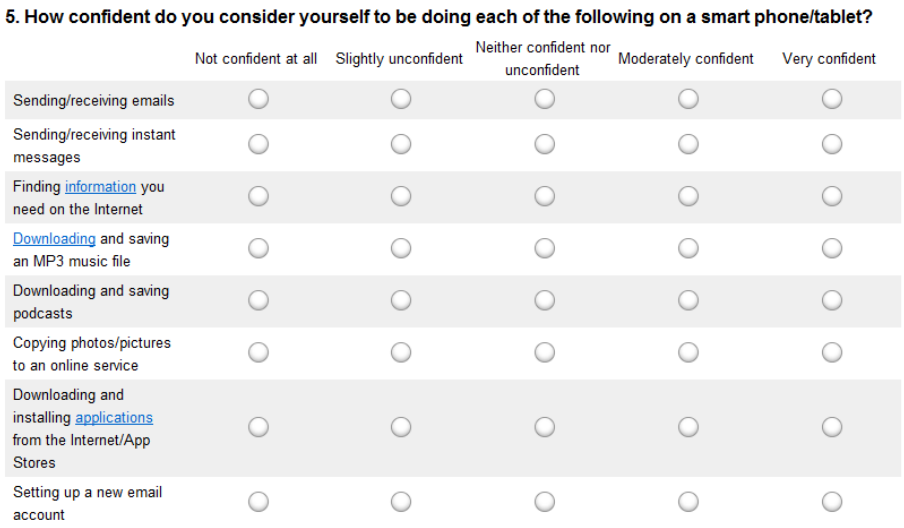
For each construct listed above respondents were asked to indicate their level of agreement or disagreement with a series of statements. Each statement reflects a related aspect pertaining to the construct that was being measured. All responses were measured on a 5-point Likert scale.

In the case of "Respondents familiarity to technology" respondents were asked how comfortable they were fulfilling a number of everyday tasks on a smartphone or tablet.

For "Attitude towards online location sharing" and "Attitude towards minor's online location sharing" respondents were asked about different elements or potential occurrences while either they or a minor were utilising Check In technology. They were asked for each statement to agree or disagree along a five point scale to ascertain their attitudes towards both constructs. Both of these series of statements included the use of reverse scaling in places.

Confidence

Figure 1. Confidence Likert Scale Items



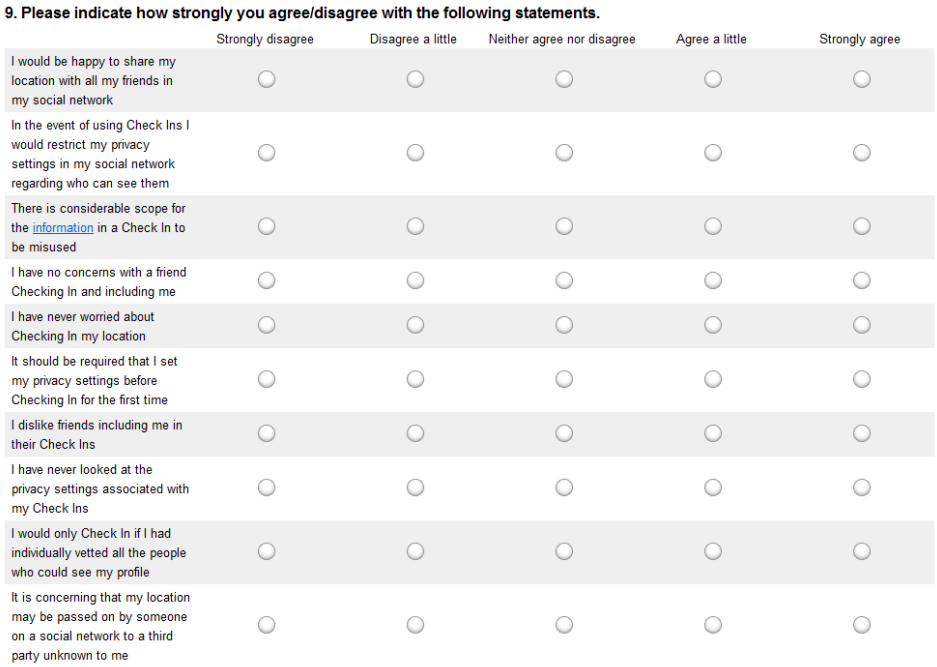
5. How confident do you consider yourself to be doing each of the following on a smart phone/tablet?

	Not confident at all	Slightly unconfident	Neither confident nor unconfident	Moderately confident	Very confident
Sending/receiving emails	○	○	○	○	○
Sending/receiving instant messages	○	○	○	○	○
Finding information you need on the Internet	○	○	○	○	○
Downloading and saving an MP3 music file	○	○	○	○	○
Downloading and saving podcasts	○	○	○	○	○
Copying photos/pictures to an online service	○	○	○	○	○
Downloading and installing applications from the Internet/App Stores	○	○	○	○	○
Setting up a new email account	○	○	○	○	○

Respondents were asked to rate how comfortable they were with undertaking each of the above tasks on a five point Likert scale. All of these tasks can be carried out regularly on a smart device and each task explores a different facet of a user's ability with a smart device. These tasks taken in aggregate give a strong illustration of how proficient a user is with their mobile phone or tablet.

Attitude

Figure 2. Attitude Likert Scale Items



9. Please indicate how strongly you agree/disagree with the following statements.

	Strongly disagree	Disagree a little	Neither agree nor disagree	Agree a little	Strongly agree
I would be happy to share my location with all my friends in my social network	○	○	○	○	○
In the event of using Check Ins I would restrict my privacy settings in my social network regarding who can see them	○	○	○	○	○
There is considerable scope for the information in a Check In to be misused	○	○	○	○	○
I have no concerns with a friend Checking In and including me	○	○	○	○	○
I have never worried about Checking In my location	○	○	○	○	○
It should be required that I set my privacy settings before Checking In for the first time	○	○	○	○	○
I dislike friends including me in their Check Ins	○	○	○	○	○
I have never looked at the privacy settings associated with my Check Ins	○	○	○	○	○
I would only Check In if I had individually vetted all the people who could see my profile	○	○	○	○	○
It is concerning that my location may be passed on by someone on a social network to a third party unknown to me	○	○	○	○	○

- In the event of using Check Ins I would restrict my privacy settings in my social network regarding who can see them
- There is considerable scope for the information in a Check In to be misused
- I have never worried about Checking In my location
- It should be required that I set my privacy settings before Checking In for the first time
- I dislike friends including me in their Check Ins
- I would only Check In if I had individually vetted all the people who could see my profile
- It is concerning that my location may be passed on by someone on a social network to a third party unknown to me

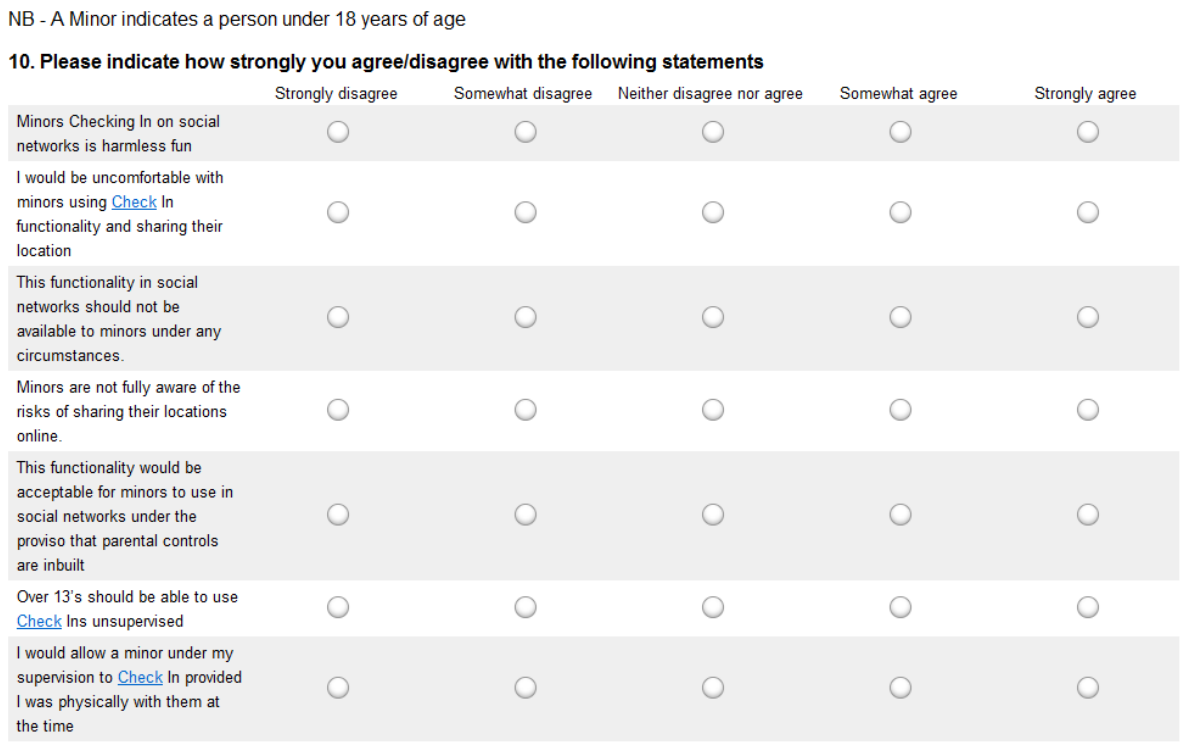
****

- I would be happy to share my location with all my friends in my social network
- I have never worried about Checking In my location
- I have no concerns with a friend Checking In and including me
- I have never looked at the privacy settings associated with my Check Ins

Each respondent was asked to indicate their level of agreement or disagreement with each of the statements above. Each of the statements relates to either a respondent's behaviour when using Check In functionality or their perception of the security and privacy of the information that they would disclose during a Check In. The first six statements are security-conscious in nature. Strong agreement with these statements would be indicate the respondent is mindful of risk and privacy when using and considering Check Ins. The final four statements (beneath the asterisk) are reverse scaled and were re-computed to reflect this prior to data analysis. Strong agreement here would be indicative of a lower level of privacy and security concern.

Minor Attitude

Figure 3. Minor Attitude Likert Scale Items



NB - A Minor indicates a person under 18 years of age

10. Please indicate how strongly you agree/disagree with the following statements

	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
Minors Checking In on social networks is harmless fun					
I would be uncomfortable with minors using Check In functionality and sharing their location					
This functionality in social networks should not be available to minors under any circumstances.					
Minors are not fully aware of the risks of sharing their locations online.					
This functionality would be acceptable for minors to use in social networks under the proviso that parental controls are inbuilt					
Over 13's should be able to use Check Ins unsupervised					
I would allow a minor under my supervision to Check In provided I was physically with them at the time					

- I would be uncomfortable with minors using Check In functionality and sharing their location
- This functionality in social networks should not be available to minors under any circumstances.
- Minors are not fully aware of the risks of sharing their locations online.

****

- Minors Checking In on social networks is harmless fun
- Over 13's should be able to use Check Ins unsupervised

****

- This functionality would be acceptable for minors to use in social networks under the proviso that parental controls are inbuilt
- I would allow a minor under my supervision to Check In provided I was physically with them at the time

Respondents were asked for their agreement or disagreement with the above statements to measure their perception regarding minors using Check In technology. The first three statements are security conscious and strong agreement would reflect concern on the part of the respondent. The two statements between the asterisks are reverse scaled items, illustrative of less concern in this area on the part of the respondent. The final two statements were included in the survey as they were thought to also be indicative of a security-conscious attitude towards minors on behalf of the respondent. However in the data analysis phase these statements caused a large degree of skew to the construct. This may be due to the introduction of the concept of guardianship and potential influence of the respondent upon a minor. As a result the final two statements were omitted from this construct in the data analysis.

A pilot of the questionnaire was tested on four respondents who responded with feedback of which the majority related to the clarity and intended purpose of some questions. Based on this feedback some wording was altered and a smaller pilot was run, resulting in significantly positive feedback. At this point the questionnaire was considered complete.

3.4 Ethics Considerations

As per being undertaken as part of a dissertation approval from the TCD Research Ethics Committee was sought and subsequently granted, with no ethical issues found as part of this process. The questionnaire was set up in Surveymonkey to allow ease of access for respondents. Anyone taking the survey is required to consent to participate as per Trinity Ethics guidelines (appendix) and may leave the study at any stage. All responses are fully anonymised and the survey was designed so as to leave respondents unidentifiable.

Data collected throughout this dissertation is subject to the Data Protection Act (2003). Foremost of its obligations are

- Data that are collected must not be excessive
- Data must not be held for longer than required
- Data processing must be explicit i.e. it must only be used for the purpose for which it was collected

The survey was designed to be compliant with all these points.

3.5 Fieldwork

The sample type is best classified as an accidental /convenience sample. All participants in the survey are employees of the Central Bank of Ireland. Within this sample body all participants were also self selecting. A link to the survey was posted on the company intranet and was left available to respondents for two weeks. After this time the link was removed and changed to prevent any further access.

This sample was chosen due to ease of access and the possibility of reaching a somewhat diverse non-student body of respondents. It is an accidental sample and not considered to be a random sample. The sample population represents a certain body of people that share similarities of attributes such as

- Predominantly highly educated
- In permanent employment
- Public sector

As a result inference to the general population will not be possible, due to the possibility of skew in the sample.

3.6 Data Preparation

After a period of two weeks the survey was closed. At this point there were one hundred and seventy-four respondents. Of the total sample twelve respondents did not complete the survey to the point where consent was given for submission of their answers. These responses were filtered out of the sample in SPSS.

An export from Surveymonkey was taken in Excel format (.xls). Surveymonkey attaches a number of metadata items to each response such as:

- Collector ID
- StartDate
- EndDate
- IP Address
- FirstName
- LastName
- CustomData

These fields were all deleted. A field named RespondentID was retained to act as a unique identifier for each response.

As Surveymonkey exports every response to its own column it was necessary to concatenate columns to reflect each question. This was completed across all the questions (excluding Question 4 and Question 8) resulting in a single column containing all answers for each question (see appendix for complete breakdown of coding values for each question).

Question 4 (How long have you been using a smart phone/tablet?) was presented as a combination of months and years in Surveymonkey. These columns were combined to give a single value in months with 72 representing the maximum value (i.e. six years or more)

Question 8 (Which of the following reasons would potentially make you Check In) was recoded as a series of dichotomies for each reason with 1 corresponding to Yes.

At this point the spreadsheet was imported into SPSS.

Within SPSS each variable was assigned a type. Any statement relating to a construct was classified as ordinal, as was SmartPhoneConfidence (Response to Question 3). UsageTime, the length of time a user has been using smart devices, was classified as a scale item. All other variables were classified as nominal

New variables were created for ConfidenceMean, AttitudeMean and MinorAttitudeMean. This variable was populated with the means of each the Likert scale items that are associated with each construct. In the case of ConfidenceMean and AttitudeMean all the scale items were used to calculate the new variable. In the case of MinorAttitudeMean five of the seven questions were used as two were contributing to significant skew in the Cronbach's Alpha score. Questions Five and Seven were omitted in this case. Means were calculated using the Compute Variable function. Multiple response sets were also created in SPSS to allow crosstabulation and frequency charting using the same sequence of questions for each construct i.e. all for Confidence and Attitude and five of seven for Minor Attitude.

A filter was then applied using the Select cases function to remove any responses that did not answer affirmatively to Question Fifteen – Are you happy to submit your answers.

At this point the research moved to the Data Analysis phase.

3.7 Conclusion

This chapter included a brief summary of the main research paradigms and data collection methods, discussed the chosen method and its potential strengths and weaknesses. It addressed the design of the data collection tool which was an online survey. This was followed by ethics considerations and an analysis of the constructs that were developed for use in this research. Data preparation and some elements of data cleaning were also noted.

4 Findings and Analysis

4.1 Introduction

This section contains all the statistical analysis of the survey data. Firstly the research question (and sub questions) will be examined to ascertain which relationships between variables and constructs are important. Then some of the more interesting frequencies of responses will be examined. Following this the statistical tests were be run. The reason for choosing each test will be briefly explained as will the purpose of each specific test. The method for running each test will be described and the results will give answers to the research question.

"Does parenthood have a significant bearing on an individual's attitude to online location sharing, and if so how does it affect their attitude?"

This research question is focused on ascertaining: Does being a parent make a large difference to the attitude of respondents towards minors and their usage of location-based social networks. A number of sub-questions seek to highlight factors within the main question

- Does attitude differ between parent and non-parents, and do they have different attitudes to minors using the technology?
- Does attitude differ between people who have Checked In and those that have not?
- Does respondent's age significantly alter their attitude and attitude to minors using Check Ins?
- Does gender cause a significant bias to the attitudes and attitude to minors using Check Ins?
- Does confidence and familiarity with smart devices influence how people consider these technologies?

In the case of these questions and throughout this research the term "Check In" is used. This is the colloquial term for the process of geo-tagging oneself within a social network. A user will update their status (or possibly tweet) and voluntarily embed their precise location geographically within the update.

Parsing through the research question and sub-questions lead to the conclusion that there are a number of different variables and constructs within the response data that require statistical examination. The most significant of these are the constructs that have been designed to measure the attitude of respondents towards security and privacy relating to themselves using Check Ins (the Attitude construct) and the attitude of respondents to minor's using Check ins (the Minor Attitude construct).SmartPhoneUser is the response to whether the respondent has ever used a smart device. Parenthood is a factor in some sub questions so the dichotomous variable "Parent" will be important, as will Gender. Age is also a significant variable. Finally the variable "EverCheckedIn" variable (dichotomous variable which asks has a user ever Checked In) and the construct Confidence (used to measure a respondents level of expertise with a smart device) will be examined and tested against other variables for relationships between them.

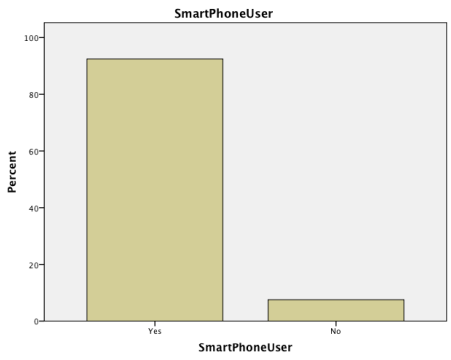
4.2 Frequencies

Variables

SmartPhoneUser

There were 162 valid responses to the survey, out of a total of 174. 12 were omitted from all statistical analysis and results as they had failed to give permission for their results to be used (Q15. Are you happy to submit your answers?). Nearly 94% of respondents are smart phone or tablet users. Only 10 respondents did not use either of these devices. This is a very high penetration level. It is possible that this is due to the sample selected (relatively high level of education, permanent employment). Research by the Pew Institute from July 2013 that 56% of the US population use smart phones or tablets. A recent Eircom survey estimated that there were 1.6 million smart phone users in the Republic of Ireland which would equate to approximately one third of the population. This would make the sample to be significantly higher than the national figures.

Figure 4. Smart Phone User Responses



Age / Gender / Parenthood

Table 1. Frequency Table - Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	76	46.9	47.2	47.2
	Male	85	52.5	52.8	100.0
	Total	161	99.4	100.0	
Missing	System	1	.6		
Total		162	100.0		

Table 2. Frequency Table - Parenthood

		Frequency	Percent	Cumulative Percent
Valid	Yes	63	38.9	38.9
	No	99	61.1	100.0
	Total	162	100.0	

Table 3. Frequency Table - Age

		Frequency	Percent	Cumulative Percent
Valid	18 - 29	32	19.8	19.8
	30 - 39	74	45.7	65.4
	40 - 49	44	27.2	92.6
	50 - 59	12	7.4	100.0
	Total	162	100.0	

Above are graphs corresponding to respondent frequencies for Gender, Parenthood and Age (which is banded). Just fewer than 40% of respondents were parents and slightly below 47% were female with 52.5% males.

The age graph bands are as follows

1. 18-29
2. 30-39
3. 40–49
4. 50-59

The majority (45.7%) were in the age range of thirty to thirty-nine with significant numbers of respondents in the age bands eighteen (19.8%) to twenty-nine and forty to forty-nine (27.2). There were 12 respondents (7.4%) in the fifty to fifty-nine band. The oldest age band (60-69) had no respondents and is not represented on this graph or anywhere else in the results.

Have you Ever Checked In

Slightly less than half of all respondents have Checked In at least once. This is significantly more than was expected as polling by Edison Research indicates that as little as 3% of Americans in 2012 had ever Checked In.

Table 4. Frequency Table – Have you Ever Checked In

EverCheckIn

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	78	48.1	48.1	48.1
	No	84	51.9	51.9	100.0
	Total	162	100.0	100.0	

Constructs

Attitude

Table 5. Attitude Likert Scale Item Responses

	Strongly disagree	Disagree a little	Neither agree nor disagree	Agree a little	Strongly agree	Total	Average Rating
I would be happy to share my location with all my friends in my social network	44.44% 72	26.54% 43	6.79% 11	13.58% 22	8.64% 14	162	2.15
In the event of using Check Ins I would restrict my privacy settings in my social network regarding who can see them	5.06% 8	3.80% 6	10.13% 16	12.66% 20	68.35% 108	158	4.35
There is considerable scope for the information in a Check In to be misused	2.50% 4	5% 8	10.63% 17	26.88% 43	55.00% 88	160	4.27
I have no concerns with a friend Checking In and including me	37.89% 61	21.74% 35	9.32% 15	19.88% 32	11.18% 18	161	2.45
I have never worried about Checking In my location	32.92% 53	23.60% 38	19.25% 31	11.80% 19	12.42% 20	161	2.47
It should be required that I set my privacy settings before Checking In for the first time	3.11% 5	1.86% 3	9.94% 16	16.15% 26	68.94% 111	161	4.46
I dislike friends including me in their Check Ins	9.32% 15	12.42% 20	24.84% 40	19.88% 32	33.54% 54	161	3.56
I have never looked at the privacy settings associated with my Check Ins	36.31% 57	11.46% 18	21.66% 34	12.74% 20	17.83% 28	157	2.64

	Strongly disagree	Disagree a little	Neither agree nor disagree	Agree a little	Strongly agree	Total	Average Rating
I would only Check In if I had individually vetted all the people who could see my profile	15.82% 25	13.29% 21	22.78% 36	18.35% 29	29.75% 47	158	3.33
It is concerning that my location may be passed on by someone on a social network to a third party unknown to me	2.47% 4	5.56% 9	4.94% 8	20.99% 34	66.05% 107	162	4.43

“Attitude” is used here as the name for a construct that is designed to measure the respondent’s sense of privacy relating to Check Ins. The questions had responses placed on a Likert scale, with 1 representing strong disagreement to statements regarding Check In privacy and security. 5 was analogous to strong agreement. The Cronbach’s Alpha score for these questions was .792 showing a high degree of internal consistency. The aggregate responses to the construct indicate that a large majority of respondents have some concern for the privacy of the information that they are sharing as part of a Check In. 47.3% of all respondents were strongly concerned with Check In privacy. 19.9% felt somewhat in agreement to the statements which corresponds to somewhat concerned. Less than 20% of responses showed disagreement with the statements which points to most respondents having at least some degree of concern relating to their Check In privacy.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.792	.799	10

MinorAttitude

Table 6. Minor Attitude Likert Scale Item Responses

	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree	Total
Minors Checking In on social networks is harmless fun	49.69% 80	32.30% 52	7.45% 12	9.32% 15	1.24% 2	161
I would be uncomfortable with minors using Check In functionality and sharing their location	11.18% 18	11.80% 19	3.73% 6	27.95% 45	45.34% 73	161
This functionality in social networks should not be available to minors under any circumstances.	6.83% 11	19.25% 31	13.04% 21	29.81% 48	31.06% 50	161
Minors are not fully aware of the risks of sharing their locations online.	4.97% 8	3.11% 5	4.97% 8	24.22% 39	62.73% 101	161
This functionality would be acceptable for minors to use in social networks under the proviso that parental controls are inbuilt	11.11% 18	16.67% 27	8.64% 14	47.53% 77	16.05% 26	162
Over 13’s should be able to use Check Ins unsupervised	38.89% 63	32.10% 52	14.81% 24	10.49% 17	3.70% 6	162
I would allow a minor under my supervision to Check In provided I was physically with them at the time	19.75% 32	15.43% 25	12.96% 21	45.68% 74	6.17% 10	162

"Minor Attitude" is a construct measuring the attitude of the respondent towards persons under the age of 18 utilising Check Ins. This construct was initially composed of 7 questions but 2 were removed from the calculations as they introduced a high degree of skew in the Cronbach's Alpha score. With the responses that caused difficulty in the Alpha score was .451 which was too low to proceed.

On recalculation without the two statements that were causing skew the Alpha score had increased to .699. This is not excellent but sufficient to show that the remaining five statements show a good degree of internal consistency. The two statements whose results are excluded exhibited a high degree of skew as they introduced the concept of guardianship over a minor while the minor was utilising Check Ins. While they have been excluded from the calculations relating to this construct they will be referred to later as they show a large degree of differentiation in respondent's views. 45.5% agreed strongly and 29.3% agreed somewhat with the statements concerning Minors Check In privacy. 8.8% of respondents neither agreed nor disagreed, 10.8% disagreed somewhat and 5.6% disagreed strongly

Original Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.7	.703	5

Confidence

There were two parts to questioning how confident a user felt about using their device. A multiple choice question was asked with four options ranging from "complete novice" through "beginner" to "intermediate" and finally "expert". This was eventually used in one of the ANOVA tests. There was also the possibility that a user may under- or over- value their own ability to operate the device. A decision was made to regard also regard this concept as a construct. A series of eight questions were set relating to everyday tasks that could be fulfilled on a smart device. The respondent scored their confidence level for each task on a Likert scale with 1 representing "Not very confident at all" and 5 "Very confident". The Cronbach's Alpha score for these questions was .858, indicating that the internal consistency between the questions was high.

Users were in the majority (63%) very confident of their ability to complete these tasks. Only 11% of the respondents considered themselves “Slightly unconfident” or “Not very confident at all” when the results are considered in aggregate. When these results are viewed in conjunction with the previous question it compares favourably with the result leading to similar percentages in each category. This could lead one to conclude that most smart phone users are accurately aware of the level of their ability to utilise their device.

Reliability Statistics

Cronbach's Alpha	N of Items
.858	8

Table 7. Confidence Likert Scale Item Responses

	Not confident at all	Slightly unconfident	Neither confident nor unconfident	Moderately confident	Very confident	Total	Average Rating
Sending/receiving emails	0.66% 1	1.32% 2	1.32% 2	12.50% 19	84.21% 128	152	4.78
Sending/receiving instant messages	3.29% 5	1.97% 3	7.89% 12	13.82% 21	73.03% 111	152	4.51
Finding information you need on the Internet	0% 0	0.66% 1	0.66% 1	14.47% 22	84.21% 128	152	4.82
Downloading and saving an MP3 music file	9.21% 14	11.84% 18	12.50% 19	21.71% 33	44.74% 68	152	3.81
Downloading and saving podcasts	13.91% 21	10.60% 16	23.84% 36	15.89% 24	35.76% 54	151	3.49
Copying photos/pictures to an	11.84%	10.53%	11.18%	21.71%	44.74%		

	Not confident at all	Slightly unconfident	Neither confident nor unconfident	Moderately confident	Very confident	Total	Average Rating
online service	18	16	17	33	68	152	3.77
Downloading and installing applications from the Internet/App Stores	3.29% 5	3.29% 5	5.26% 8	17.11% 26	71.05% 108	152	4.49
Setting up a new email account	3.29% 5	1.32% 2	8.55% 13	21.05% 32	65.79% 100	152	4.45

4.3 Testing

In order to evaluate similarities and differences between variables that were gathered during the data collection phase appropriate statistical tests were run. The tests and variables tested are described in the section that follows.

An independent sample t-test is an appropriate test to evaluate whether there is a difference between the mean of a dependent variable (such as Attitude) in either of two independent groups (such as Male and Female in Gender). In order to test the Likert scale items a mean value was created by summing the values of each scale item and recording this in a new variable. In the case of the Confidence construct this variable was called ConfidenceMean, for the Attitude construct it is called AttitudeMean and for the Minor Attitude construct it is MinorAttitudeMean. The test measures if the population means are equal. If the means are proven to be equal then there is a failure to reject the null hypothesis and there is no significant difference between each group.

Using this new variable an independent samples t-test allowed the comparison of the following pairs of variables

- Gender (nominal dichotomous) & AttitudeMean (continuous)
- Gender (nominal dichotomous) & MinorAttitudeMean (continuous)
- Parenthood (nominal dichotomous) & AttitudeMean (continuous)
- Parenthood (nominal dichotomous) & MinorAttitudeMean (continuous)
- EverCheckedIn (nominal dichotomous) & AttitudeMean (continuous)
- EverCheckedIn (nominal dichotomous) & MinorAttitudeMean (continuous)

The format of the null hypothesis in each of the above cases takes the following format:

H_0: Mean of (continuous variable) of (nominal variable Group 1)is equal to mean of (continuous variable) of (nominal variable Group 2)

And the alternative hypothesis would be expressed

H_1: Mean of (continuous variable) of (nominal variable Group 1) is **not** equal to mean of (continuous variable) of (nominal variable Group 2)

Throughout this research an alpha value of 0.05 is used.

The p-value is the result of the statistical tests that were run in this research. The p value represents the confidence level (probability) that the null hypothesis is correct and cannot be rejected.

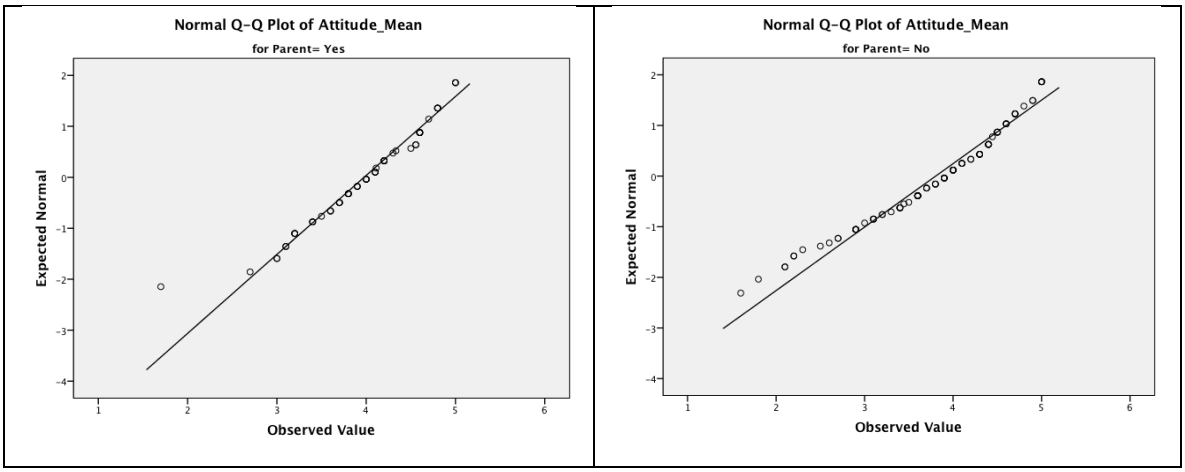
There are a number of assumptions that need to be fulfilled for the independent t-tests to be valid.

1. Independence of observation – This rule states that there must be no participant as a member of both groups that are tested. This was proven true in all the nominal variables tested here, as they are all dichotomous (Gender, Parent, EverCheckIn). Membership of both groups is not possible.

2. No outliers–There were no significant outliers in the data.

3. Normality of distribution – The distributions of the population means were approximately normal. – For example: The distributions for Parent and AttitudeMean

Figure 5. Distribution of Means for Attitude Mean and Minor Attitude Mean



4. Homogeneity of variances – This was tested using Levenes test for Equality of Variances and reported during each individual test.

4.3.1 Gender and Attitude

H_0: There is no difference between males and females with regards to attitudes using Check Ins

There is no difference between male and female attitudes regarding Check Ins

This is a test to understand is there a statistically significant difference between men and women regarding their perception of their own privacy and security while using Check Ins.

The function to run the independent t-test for this data was utilised in SPSS with the output displayed below.

Table 8. Gender & Attitude Means Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Attitude_Mean	Female	76	3.8004	.79542	.09124
	Male	82	3.9256	.69575	.07683

Table 9. Gender & Attitude Homogeneity of Variances

Levene's Test for Equality of Variances	
F	Sig.
1.704	.194

From the results above it can be reported that males (3.92 ± 0.69) mean scores regarding attitude to Check Ins was higher than that of females (3.8 ± 0.79).

There was homogeneity of variances for AttitudeMean scores for males and females as assessed by Levene's test for Equality of Variances (p = .194)

Table 10. Gender & Attitude t-test results

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Attitude_Mean	Equal variances assumed	-1.055	156	.293	-.12517	.11868	-.35959	.10925

Female mean AttitudeMean was -0.12 (95% Confidence Interval, -0.35 to 0.10) lower than Male mean AttitudeMean

There was no statistically significant difference in AttitudeMean between females and males, $t(156) = -1.055$, $p = .293$

The above tests have shown that the null hypothesis has failed to be rejected.

What this means in practise is that men and women within this sample population have shown similar inclinations towards their privacy concern when regarding Check In technologies and neither gender is significantly more security conscious than the other.

4.3.2 Gender and Minor Attitude

H_0: There is no difference between males and females with regards their attitudes to minors using Check Ins

This is a test will show is there a statistically significant difference between men and women regarding their concern for the privacy and security of minors (referring to persons under eighteen years old) utilising Check In technology

Table 11. Gender & Minor Attitude Means Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
MinorAttitude_Mean	Female	76	4.0289	.82021	.09408
	Male	85	3.9459	.78157	.08477

Table 12. Gender & Minor Attitude Homogeneity of Variances

Levene's Test for Equality of Variances	
F	Sig.
.061	.805

Table 13. Gender & Minor Attitude t-test results

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
MinorAttitude_Mean	Equal variances assumed	.658	159	.512	.08307	.12630	-.16638	.33251

From the results on the previous page it can be reported that females mean scores (4.02 ± 0.82) relating to this variable were higher than males (3.94 ± 0.78).There was homogeneity of variances for MinorAttitudeMean scores for males and females as assessed by Levene's test for Equality of Variances (p = .805). Female mean MinorAttitudeMean was .083 (95% Confidence Interval, -0.16 to 0.33) higher than Male mean MinorAttitudeMean. There was no statistically significant difference in MinorAttitudeMean between Females and Males, $t(159) = .658$, $p = .512$

This test has shown that there is no significant difference between males and females when they consider the privacy and security of minors utilising Check Ins. The null hypothesis cannot be rejected.

4.3.3 Parents and Attitude

H_0: There is no difference between parents and non-parents with regards their attitudes to using Check Ins

This test will show if there is a statistically significant difference between parents and non-parents regarding their attitudes towards security and privacy when they use Check Ins.

Table 14. Parenthood & Attitude Means Group Statistics

	Parent	N	Mean	Std. Deviation	Std. Error Mean
Attitude_Mean	Yes	62	3.9767	.64538	.08196
	No	96	3.7935	.79873	.08152

Table 15. Parenthood and Attitude Homogeneity of Variances

Levene's Test for Equality of Variances	
F	Sig.
3.584	.060

Table 16. Parenthood & Attitude t-test results

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Attitude_Mean	Equal variances assumed	1.514	156	.132	.18318	.12098	-.05579	.42216

From the results above it can be reported that parents mean scores (3.97 ± 0.64) were higher than non-parents (3.79 ± 0.79).There was homogeneity of variances for AttitudeMean scores for males and females as assessed by Levene's test for Equality of Variances (p = .060). Parents mean AttitudeMean was .18 (95% Confidence Interval, -0.05 to 0.42) higher than non-parents mean AttitudeMean. There was no statistically significant difference in AttitudeMean between parents and non-parents, $t(156) = 1.51$, $p = .132$

This test has shown that there is no significant difference between parents and non-parents when they consider their own privacy and security when considering Check Ins. The null hypothesis cannot be rejected.

4.3.4 Parents and Minor Attitude

H_0: There is no difference between parents and non-parents with regards their attitudes to using Check Ins

This test will show if there is a statistically significant difference between parents and non-parents regarding their attitudes for the privacy and security of minors (referring to persons under eighteen years old) utilising Check In technology

Table 17. Parenthood & Minor Attitude Means Group Statistics

	Parent	N	Mean	Std. Deviation	Std. Error Mean
MinorAttitude_Mean	Yes	63	4.0540	.74245	.09354
	No	98	3.9408	.83343	.08419

Table 18. Parenthood and Minor Attitude Homogeneity of Variances

Levene's Test for Equality of Variances	
F	Sig.
.597	.441

Table 19. Parenthood & Minor Attitude t-test results

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
MinorAttitude_Mean	Equal variances assumed	.877	159	.382	.11315	.12906	-.14173	.36804

From the output of this test it can be reported that parents mean scores (4.05 ± 0.74) were higher than non-parents (3.94 ± 0.83). There was homogeneity of variances for MinorAttitudeMean scores for parents and no-parents as assessed by Levene's test for

Equality of Variances (p = .441). Parents mean MinorAttitudeMean was .11 (95% Confidence Interval, -0.14 to 0.36) higher than non-parents mean MinorAttitudeMean. There was no statistically significant difference in MinorAttitudeMean between parents and non-parents, $t(159) = .888$, $p = .382$

This test has shown that there is no significant difference between parents and non-parents when they consider the privacy and security of minors utilising Check Ins. The null hypothesis cannot be rejected.

4.3.5 Ever Checked In and Attitude

H_0: There is no difference between those who have previously Checked In and those who have not with regards their attitudes to using Check Ins

This test will show if there is a statistically significant difference in Attitude between people who have previously used Check Ins as opposed to those who have never used the technology.

Table 20. Ever Checked In & Attitude Means Group Statistics

	EverCheckIn	N	Mean	Std. Deviation	Std. Error Mean
Attitude_Mean	Yes	78	3.5453	.78810	.08924
	No	80	4.1775	.54736	.06120

Table 21. Ever Checked In and Attitude Homogeneity of Variances

Levene's Test for Equality of Variances	
F	Sig.
9.553	.002

Table 22. Ever Checked In & Attitude t-test results

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Attitude_Mean	Equal variances not assumed	-5.843	136.937	.000	-.63220	.10820	-.84617	-.41823

Group that have previously Checked In will be called HaveCheckedIn as shorthand. Group that have not previously Checked In will be called HaveNotCheckedIn.

From the results above it can be reported that those who have never checked in (4.17 ± 0.78) were more concerned with Attitude than respondents who have Checked In (3.54 ± 0.54).There was not homogeneity of variances for AttitudeMean scores for two groups as assessed by Levene's test for Equality of Variances ($p = .002$).

HaveCheckedIn'smean AttitudeMean was -.63 (95% Confidence Interval, -0.84 to -0.41) lower than HaveNotCheckIn's mean AttitudeMean. There is a statistically significant difference in AttitudeMean between both groups, $t(136) = -5.84$, $p = .000$

The null hypothesis is rejected.

This test has shown that there is a significant difference between the two groups of respondents. Those that have never Checked In are more conscious and concerned when regarding Check In technologies and associated behaviours that the group who have Checked In.

4.3.6 Ever Checked In and Minor Attitude

H_0: There is no difference between those who have previously Checked In and those who have not with regards their attitudes to minors using Check Ins

This test will show if there is a statistically significant difference in Minor Attitude between people who have previously used Check Ins as opposed to those who have never used the technology when considering the privacy and security of minors (referring to persons under eighteen years old) utilising Check In technology

Table 23. Ever Checked In & Minor Attitude Means Group Statistics

	EverCheckIn	N	Mean	Std. Deviation	Std. Error Mean
MinorAttitude_Mean	Yes	77	3.8026	.87208	.09938
	No	84	4.1524	.68837	.07511

Table 24. Ever Checked In and Minor Attitude Homogeneity of Variances

Levene's Test for Equality of Variances	
F	Sig.
5.954	.016

Table 25. Ever Checked In & Minor Attitude t-test results

Independent Samples Test

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
MinorAttitude_Mean	Equal variances not assumed	-2.808	144.457	.006	-.34978	.12457	-.59600	-.10357

From the results on the previous page it can be reported that those who have never checked in (4.15 ± 0.68) were more concerned with Minor Attitude than respondents who have Checked In (3.80 ± 0.87). There was not homogeneity of variances for MinorAttitudeMean scores for two groups as assessed by Levene's test for Equality of Variances (p = .016).

HaveCheckedIn'smean MinorAttitudeMean was -.34 (95% Confidence Interval, -0.59 to -0.10) lower than HaveNotCheckIn's mean MinorAttitudeMean. There is a statistically significant difference in MinorAttitudeMean between both groups, $t(144) = -2.808$, $p = .006$

The null hypothesis is rejected.

This test has shown that there is a significant difference between the two groups of respondents. Those that have never Checked In are more conscious and concerned regarding minors using Check In technologies that the group who have Checked In.

4.3.7 Age and Attitude

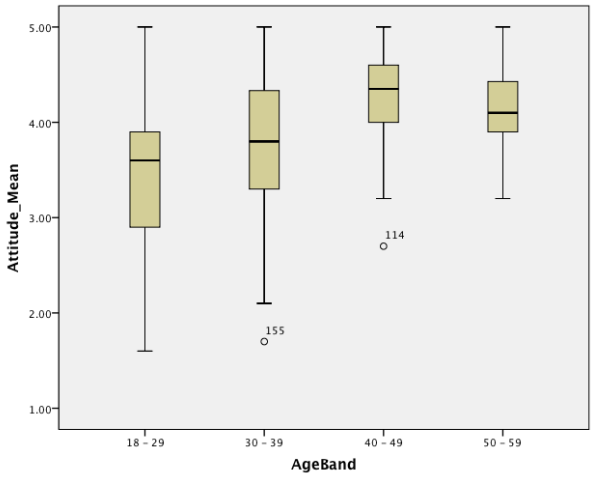
Respondents were asked which age band they fell into. In order to test if age has an effect on Attitude and Minor Attitude it will be required to run a one-way analysis of variance (ANOVA) test as there are four groups within the independent variable. This test is an extension of the independent samples t-test as was run previously that has been extended to allow for more groups.

The null hypothesis for this test is H_0: all group means are equal.

There are three assumptions necessary for an ANOVA to be valid.

1. There should be no outliers in the data – There were a number of outliers as shown in the box plot below – to overcome this the Kruskal-Wallis H non-parametric test was also be run on the same data and compared to verify the findings

Figure 6. Age & Attitude Mean Box Plot of Distributions



2. Each groups data is normally distributed – A test (Shapiro-Wilk) was run to check normality of distribution. One age band (40-49) was found to not have normal distribution. This was also overcome by comparing the findings to the Kruskal-Wallis findings.
3. Each group's data has equal variance – Homogeneity of variance is tested below

Table 26. Age & Attitude - Homogeneity of Variances

Attitude_Mean

Levene Statistic	df1	df2	Sig.
4.340	3	155	.006

The assumption of homogeneity of variances was violated (p=.006). In order to produce a valid result a more robust version of ANOVA was run. Welch's ANOVA was used.

Table 27. Age & Attitude - Descriptive Statistics

Attitude_Mean

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
18 - 29	32	3.4125	.86463	.15285	3.1008	3.7242	1.60	5.00
30 - 39	74	3.8117	.73458	.08539	3.6415	3.9819	1.70	5.00
40 - 49	42	4.2190	.50391	.07775	4.0620	4.3761	2.70	5.00
50 - 59	11	4.1061	.50668	.15277	3.7657	4.4465	3.20	5.00
Total	159	3.8593	.74717	.05925	3.7423	3.9764	1.60	5.00

Attitude increased from age band 18-29 (3.4 ± 0.86), through the 30-39 age band (3.8 ± 0.73), peaking for the 40-49 age band (4.2 ± 0.5) and dropping for the 50-59 age band (4.1± 0.5).

Figure 7. Means of Attitude Mean

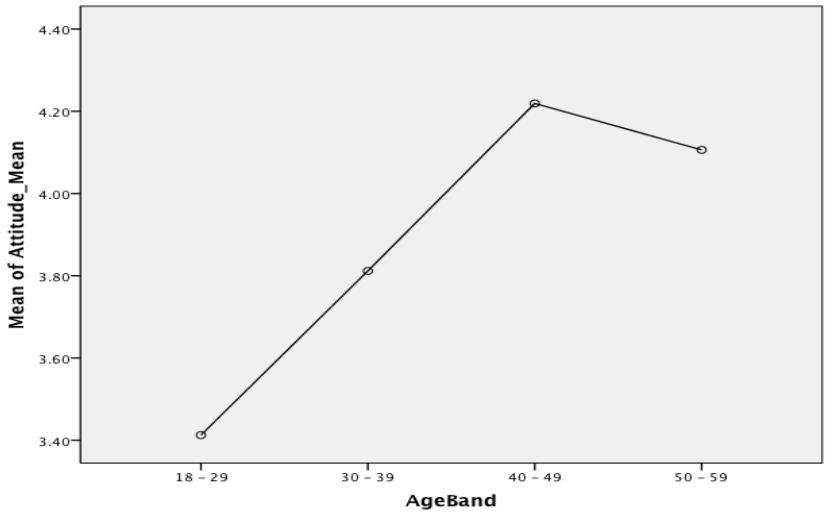


Table 28. Age & Attitude - Welch's ANOVA Results

Attitude_Mean

	Statistic[a]	df1	df2	Sig.
Welch	8.979	3	42.215	.000

a. Asymptotically F distributed.

Attitude was statistically significantly different between different age bands group, Welch's $F(3,42.2) = 9.0$, $p < .0005$.

Table 29. Age & Attitude Mean - Multiple Comparisons

Dependent Variable: Attitude_Mean

	(I) AgeBand	(J) AgeBand	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Games-Howell	30 - 39	18 - 29	.39921	.17508	.116	-.0657	.8641
	40 - 49	18 - 29	.80655	.17149	.000	.3497	1.2634
		30 - 39	.40734	.11549	.003	.1060	.7086
		50 - 59	.11299	.17142	.911	-.3788	.6048
	50 - 59	18 - 29	.69356	.21610	.016	.1062	1.2809
		30 - 39	.29435	.17502	.363	-.2032	.7918

This is the results of the Games-Howell test of means differences between groups. It has shown that there is a statistically significant difference in Attitude Mean between three groups.

There was an statistically significant increase in Attitude Mean from 3.4 ± 0.86 in the 18-29 age bracket to 4.2 ± 0.5 in the 40-49 age bracket, an increase of 0.80 (95%CI, 0.35 to 1.2)

There was an statistically significant increase in Attitude Mean from 3.8 ± 0.73 in the 30-39 age bracket to 4.2 ± 0.5 in the 40-49 age bracket, an increase of 0.41 (95%CI, 0.1 to 0.71)

There was an statistically significant increase in Attitude Mean from 3.4 ± 0.86 in the 18-29 age bracket to 4.1 ± 0.5 in the 50-59 age bracket, an increase of 0.7 (95%CI, .1 to 1.3)

The results of the of the Kruksal-Wallis H test (below) concur in that the null hypothesis should be rejected.

Figure 8. Age & Attitude Mean - Kruskal-Wallis R Result

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Attitude_Mean is the same across categories of AgeBand.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

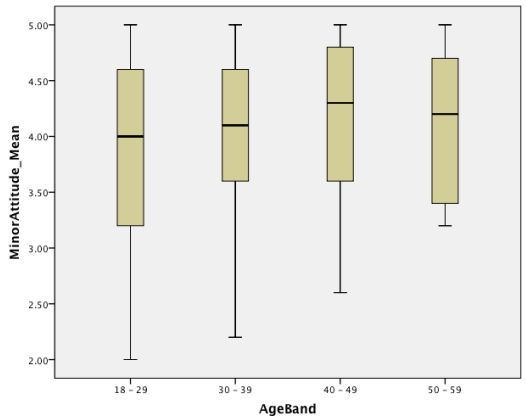
These tests have proven that age has an effect on a respondent's score in Attitude that is lessened as the respondent's age increases

4.3.8 Age and Minor Attitude

This test was run to ascertain if there was statistical differences between Age bands and their Minor Attitude scores. As in the previous test an ANOVA was run. The same assumptions are required for the test to be valid. The null hypothesis for this test is H_0: all group means are equal.

1. There should be no outliers in the data – In this instance there were no outliers on the data as displayed by the box plot below.

Figure 9. Age & Minor Attitude Mean Box Plot of Distributions



2. Each group's data is normally distributed – A test (Shapiro-Wilk) was run to check normality of distribution. Two age bands (30-39, 40-49) were found to not have normal distributions. Again the Kruskal-Wallis test will be run to verify findings.
3. Each group's data has equal variance – Homogeneity of variance is tested below

Table 30. Age & Minor Attitude - Homogeneity of Variances

MinorAttitude_Mean

Levene Statistic	df1	df2	Sig.
1.119	3	158	.343

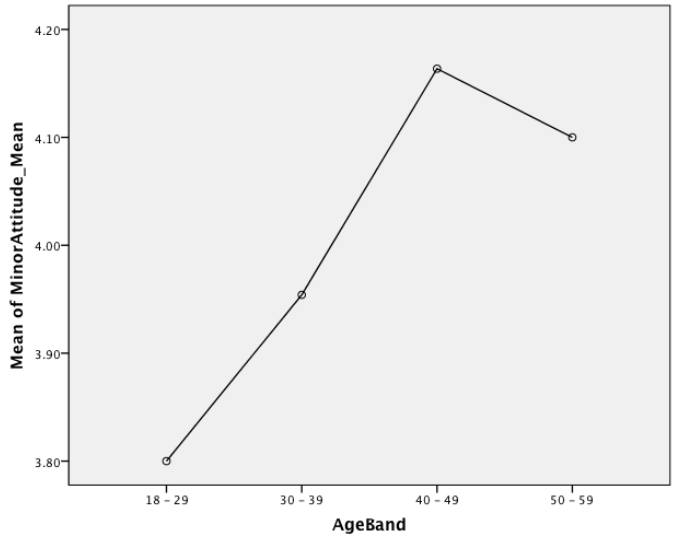
There was homogeneity of variances as assessed by Levene's Test of Homogeneity of Variance (p=.343)

Table 31. Age & Minor Attitude - Descriptive Statistics

MinorAttitude_Mean

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
18 - 29	32	3.8000	.92283	.16313	3.4673	4.1327	2.00	5.00
30 - 39	74	3.9541	.79832	.09280	3.7691	4.1390	2.20	5.00
40 - 49	44	4.1636	.71564	.10789	3.9461	4.3812	2.60	5.00
50 - 59	12	4.1000	.70065	.20226	3.6548	4.5452	3.20	5.00
Total	162	3.9914	.80011	.06286	3.8672	4.1155	2.00	5.00

Figure 10. Means of Minor Attitude Mean



Minor Attitude increased from age band 18-29 (3.8 ± 0.92), through the 30-39 age band (3.9 ± 0.8), peaking for the 40-49 age band (4.2 ± 0.7) and dropping for the 50-59 age band (4.1 ± 0.7).

Table 32. Age & Minor Attitude - ANOVA Results

MinorAttitude_Mean

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.722	3	.907	1.429	.236
Within Groups	100.346	158	.635		

Total	103.068	161			

In this case there was no statistically significant difference in Minor Attitude between the different age bands, $F(3,158) = 1.43$, $p = .236$. As a result the null hypothesis failed to be rejected.

This was borne out by the results of the Kruskal-Wallis test

Figure 11. Age & Attitude Mean - Kruskal-Wallis R Result

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of MinorAttitude_Mean is the same across categories of AgeBand.	Independent-Samples Kruskal-Wallis Test	.351	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

4.3.9 Confidence and Attitude

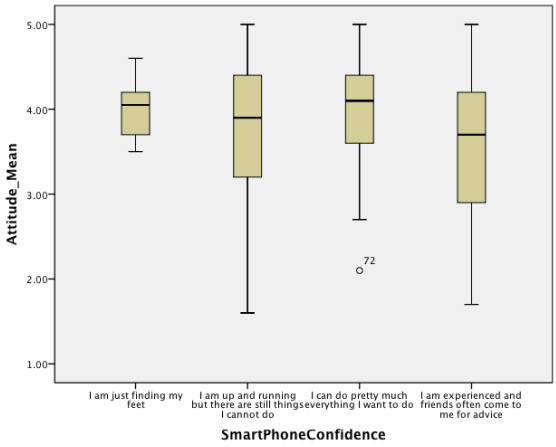
This test was run were to analyze if there was a statistically significant difference between how confident a respondent was using a smart phone or tablet and their attitudes their own Check Ins and their attitudes to minors using the technology. The test that was required in this case was also an ANOVA

The null hypothesis for this test is H_0: all group means are equal.

The same assumptions were required for test validity

1. There should be no outliers in the data – There was a single outliers as shown in the box plot below – the Kruskal-Wallis test was run to verify the results

Figure 12. Confidence and Attitude Box Plot of Distributions



2. Each groups data is normally distributed –Shapiro-Wilk was run to check normality of distribution. All groups were normally distributed.

3. Each group's data has equal variance – Homogeneity of variance is tested below

Table 33. Confidence and Attitude – Homogeneity of Variances

Attitude_Mean

Levene Statistic	df1	df2	Sig.
3.953	3	146	.010

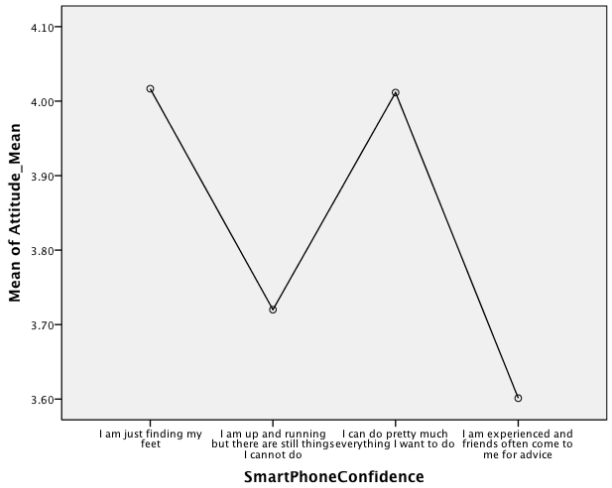
The assumption of homogeneity of variances was violated (p=.010). In order to produce a valid result a more robust version of ANOVA was run. In this case Welch's ANOVA was used.

Table 34. Confidence & Attitude - Descriptive Statistics

Attitude_Mean

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
I am just finding my feet	6	4.0167	.38687	.15794	3.6107	4.4227	3.50	4.60
I am up and running but there are still things I cannot do	30	3.7200	.83721	.15285	3.4074	4.0326	1.60	5.00
I can do pretty much everything I want to do	77	4.0115	.59945	.06831	3.8755	4.1476	2.10	5.00
I am experienced and friends often come to me for advice	37	3.6012	.86036	.14144	3.3143	3.8881	1.70	5.00
Total	150	3.8522	.73276	.05983	3.7340	3.9704	1.60	5.00

Figure 13. Means of Confidence & Attitude



Attitude mean varied throughout the respondent groups. The respondents who were least confident with their device scored highest (4.02 ± 0.39), dropping to the next group (3.72 ± 0.84), rising again for the moderately confident group (4.01 ± 0.60) and dropping again for the most confident respondent group (3.6 ± 0.38)

Table 35. Confidence & Attitude - Welch's ANOVA Results

Robust Tests of Equality of Means

Attitude_Mean

	Statistic[a]	df1	df2	Sig.
Welch	2.832	3	24.359	.059

a. Asymptotically F distributed.

Using the robust equality of means test there was no statistically significant difference in Attitude between the different levels of confidence as reported by the respondents, $F(3, 24.4) = 2.83$, $p = .059$. As a result the null hypothesis failed to be rejected.

The results of the Kruksal-Walls verified the findings.

Figure 14. Confidence & Attitude - Kruskal-Wallis R Result

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Attitude_Mean is the same across categories of SmartPhoneConfidence.	Independent-Samples Kruskal-Wallis Test	.075	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

4.3.10 Confidence and Minor Attitude

This test analyzed any difference in means between how confident a respondent was using a smart phone or tablet and their attitude to minors using the technology.

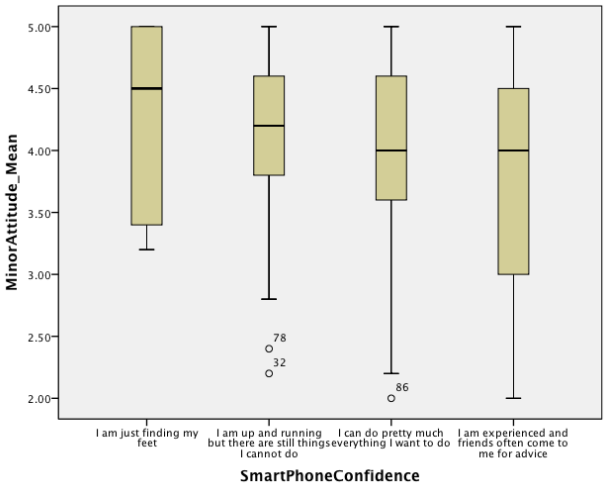
The test was an ANOVA

The null hypothesis for this test is H_0: all group means are equal.

The assumptions for validity are

1. There should be no outliers in the data – There was a single outliers as shown in the box plot below – the Kruskal-Wallis test was run to verify the results

Figure 15. Confidence and Minors Attitude Means Box Plot of Distributions



2. Each groups data is normally distributed –Shapiro-Wilk was run to check normality of distribution. Two groups were found to not have normal distribution. Kruskal-Walls was used to verify the findings.

3. Each group's data has equal variance – Homogeneity of variance is tested below

Table 36. Confidence and Minor Attitude – Homogeneity of Variances

MinorAttitude_Mean

Levene Statistic	df1	df2	Sig.
1.180	3	146	.320

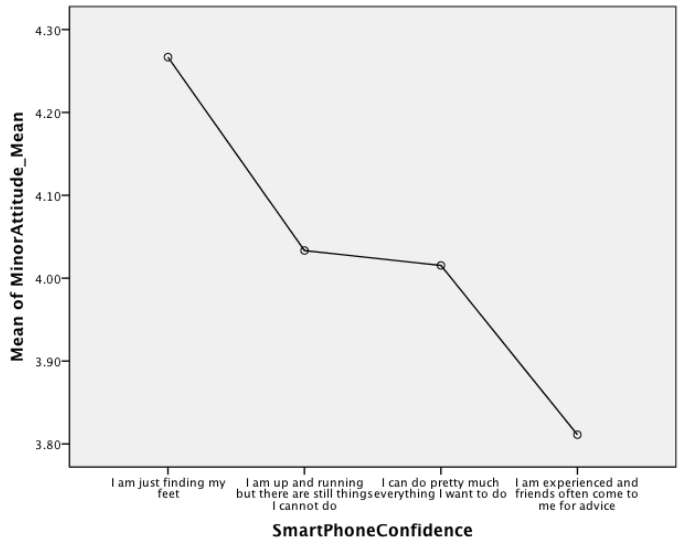
There was homogeneity of variances, as assessed by Levene's Test of Homogeneity of Variance (p = .320).

Table 37. Confidence & Minor Attitude - Descriptive Statistics

MinorAttitude_Mean

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
I am just finding my feet	6	4.2667	.78655	.32111	3.4412	5.0921	3.20	5.00
I am up and running but there are still things I cannot do	30	4.0333	.79148	.14450	3.7378	4.3289	2.20	5.00
I can do pretty much everything I want to do	78	4.0154	.77142	.08735	3.8415	4.1893	2.00	5.00
I am experienced and friends often come to me for advice	36	3.8111	.90326	.15054	3.5055	4.1167	2.00	5.00
Total	150	3.9800	.80826	.06599	3.8496	4.1104	2.00	5.00

Figure 16. Means of Confidence & Minor Attitude



Minor Attitude mean dropped throughout as the respondents confidence utilising their device rose. The respondents who were least confident with their device scored highest (4.27 ± 0.79), dropping to the next group (4.03 ± 0.79), continuing to drop for the moderately confident group (4.01 ± 0.77) and recording the lowest level for the most confident respondent group (3.8 ± 0.90)

Table 38. Confidence & Minor Attitude - ANOVA Results

MinorAttitude_Mean

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.703	3	.568	.867	.460
Within Groups	95.637	146	.655		
Total	97.340	149			

There was no statistically significant difference in Attitude between the different levels of confidence as reported by the respondents, $F(3, 146) = .867$, $p = .460$. As a result the null hypothesis failed to be rejected.

The results of the Kruksal-Walls verified the findings.

Figure 17. Confidence & Minor Attitude - Kruskal-Wallis R Result

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of MinorAttitude_Mean is the same across categories of SmartPhoneConfidence.	Independent-Samples Kruskal-Wallis Test	.542	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

4.4 Conclusion

This chapter discussed the key data that was collected for use in this piece of research, including frequency of responses to variables and likert scale items. It includes data analysis and describes the statistically robust methods used to verify findings in answer to the research question and sub questions.

5 Conclusions and Future Work

5.1 Introduction

This piece of research was begun with the aim of establishing whether a parent's attitude towards minors using geo-location technologies (known colloquially as Checking In) was significantly different to a non-parents attitude. In this study "attitude" refers to a construct which represents the level of concern a respondent has relating to the potential misuse of the information they would share during a Check In. "Minor attitude" is a measurement of a respondent's security and privacy concerns when considering minors utilising the technology. A minor refers to a person under eighteen years old. The reason for the distinction is that was a parent would be more conscious and concerned for their own child's welfare and security. Testing whether this is actually factually true is beyond the scope of this research. There was a specific interest in understanding if parenthood was a significant factor in how a respondent considered their own level of security with regard to Check Ins. The study also sought to understand does parenthood have an effect on how an individual considers minors utilising Check In technologies.

Also of interest within the scope of the research question was to examine if there were any other factors that influenced the level of concern a respondent exhibited. Some of the factors considered were gender, age, confidence using a smart device and previous usage of geo-location technologies.

5.2 Analysis of Findings

The frequency counts of some of the data collected were interesting in and of themselves. In the sample population close to 94% of respondents said they were smart device users. That is a very high percentage of respondents; well above levels that have been found in national populations. Pew Institute research found 46% of Americans in 2012 use smart phones or tablets. Also notable was that nearly half of all respondents had Checked In at least once. This is significantly greater that would be found in a random sample of the general population. Although growth in this area is explosive (4% of Americans used location-aware social networks in 2010 but that figure had risen to 18% by 2012) it is unlikely to explain the figures within this population.

The reason assumed is due to bias in the sample. This research can only indicate the attitudes of this subgroup of the population. It is not possible to infer whether the general population have similar attitudes due to the nature of the sample. The majority of the respondents in the sample population would be relatively well educated and in stable employment (this is important as financing a smart device could be a barrier to technology adoption).

The research question was:

“Does parenthood have a significant bearing on an individual’s attitude to online location sharing, and if so how does it affect their attitude?”

The focus of this research was to ascertain the attitudes of individuals towards their own considerations of privacy when using Check In technologies and also attitudes relating to minors using the same technologies. Factors such as gender, parenthood and age were measured in an attempt to understand if they had an effect on the attitude of respondents. Analysis of the results show that within this sample parenthood does not lead individuals to have a difference of attitude towards Check In technologies either with regard to themselves or towards minors. This is not to say that respondents were unaware of their security, only that there was insufficient difference between the two group’s responses to statistically

significant. Gender was also found to have no statistically significant bearing towards the attitude of a respondent.

However it was found that people who have never used the technology were significantly more aware of their own security and privacy than those who have used Check Ins in the past. This result was mirrored in the findings that concerned minors using the technology. Further granularity within this particular would make for an interesting point of further study. Age considered in conjunction with a respondent having previously used the technology could shed some light in this area as it is possible that many of those that responded as having not used Check Ins could also be those in the older age bands that were most security conscious.

Age does have an effect on a respondent. When considering their own security there were significant differences in attitude, with respondents in the older age categories proving more wary of the technology than younger respondents. This result was not replicated when considering minors, as there were no significant differences in their attitudes between any of the age categories. Confidence and comfort with a smart device was also measured and was found to have no bearing on attitude either when respondents considered themselves or considered minors.

The results have interesting connotations. It is possible to assume on first thought that females may be more prone to security-consciousness when thinking about their own Check In behaviours than males. Or that parents would be more likely to consider security issues regarding minors using these technologies a little more carefully than non-parents. However this research has shown that to not be the case.

In summary it can be said that within the sample population that was gathered for this research both gender and parenthood have no effect on how security and privacy conscious an individual is when they are considering both themselves and minors using geo-location

technologies. People who have never used the technologies are significantly more wary than those who have not used them. Age has a significant effect on how people feel about using Check Ins themselves, but this effect is lessened when they think about minors utilising the technology. Finally confidence and comfort using smart devices does not show any significant difference within either test.

One of the limitations of this survey has been the sample type. As a convenience sample it is impossible to accurately infer if any trends that have occurred in this research would be applicable to the national population. As previously noted the sample population was predominantly well educated and in stable employment. This would drop some barriers to technology adoption. From an alternative perspective there could also be many more frivolous youths or technology-wary elders in the national population which would lead to many different results compared to those found here. The approach of survey also presents limitations. There are areas within the questionnaire where mixed method research and in particular interviewing would have been a useful tool in understanding motivational factors behind respondent's answers.

There has been little in the way of previous study in this explicit area and it is hoped that there could be more studies of this nature in the coming months and years. Trends and research indicate that usage of the technologies that are the focus of this research are growing exponentially which was one of the attractions of the subject matter. It is the opinion of this researcher that (as with all computing) they will become ever more ubiquitous and understanding of the factors that influence individuals attitudes to both the technology and its uses are well worth further study. Even within the data collected for this study there is more that could be done. It would be possible to examine whether having male or female children changes concern levels. Or if a parent who has had many children is slightly less concerned that the parent of a single child. If a random sample was taken from the national population then there are many fascinating possibilities. Obviously the limitations inherent in this study would fall away but many more avenues of investigation are opened. Does wealth or earnings cause a difference in opinion? Do respondents in one sector of the economy fell much more strongly than others in various other sectors? Do non-nationals that are settled in Ireland feel more strongly than others? A broader study could give definitive answers to these questions and many more.

With little previous research in this area it was only possible to base any assumptions as to what the results may eventually be on a hunch. An expectation that “this is the way things are”. This study has thrown up some interesting findings that have not always obliged in that regard.

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Appendix A – Survey

Section 1

Familiarity with technology

1. Do you use a smart phone/tablet? (If No please skip to Section 2)

2. How would you rate yourself at using a smart phone/tablet? (tick one)

- ☐ I am just finding my feet
- ☐ I am up and running but there are still things I cannot do
- ☐ I can do pretty much everything I want to do
- ☐ I am hot and friends often come to me for advice

3. How long have you been using a smart phone/tablet? _____Months _____Years

4. How confident do you consider yourself to be doing each of the following on a smart phone/tablet?

	not very confident						very confident
Sending/receiving emails	☐	☐	☐	☐	☐	☐	☐
Sending/receiving instant messages	☐	☐	☐	☐	☐	☐	☐
Finding information you need on the Internet	☐	☐	☐	☐	☐	☐	☐
Downloading and saving an MP3 music file	☐	☐	☐	☐	☐	☐	☐
Downloading and saving podcasts	☐	☐	☐	☐	☐	☐	☐
Copying photos/pictures to an online service	☐	☐	☐	☐	☐	☐	☐
Downloading and installing applications from the Internet/App Stores	☐	☐	☐	☐	☐	☐	☐
Setting up a new email account	☐	☐	☐	☐	☐	☐	☐

Section 2

Attitude towards oneself using online location sharing

1. **Have you ever "Checked In" or tagged yourself or others (as a group) in a location suing a social network? (If No please skip to question 4)**
2. **How frequently would you Check In or tag yourself or others (as a group) using social networks**
3. **Which of the following reasons would provoke you to Check In/tag yourself (tick all that apply)**
   - ☐ Social Event (Concert/Art Showing/Sports Event)
   - ☐ Social Affairs Event (Political/Current Affairs Event)
   - ☐ Publicising an ad hoc meeting with friends
   - ☐ Other (please specify_____)

4. **Please indicate how strongly you agree/disagree with the following statements**

	Strongly disagree						Strongly agree
I am happy for myself to share my location with all my friends in my social network	☐	☐	☐	☐	☐	☐	☐
I have restricted my privacy settings in my social network regarding who can see my Check Ins	☐	☐	☐	☐	☐	☐	☐
There is considerable scope for the information in a Check In to be misused	☐	☐	☐	☐	☐	☐	☐
I have no concerns with a friend Checking In and including me	☐	☐	☐	☐	☐	☐	☐
I have never worried about Checking In my location	☐	☐	☐	☐	☐	☐	☐
It should be required that I set my privacy settings before Checking In for the first time	☐	☐	☐	☐	☐	☐	☐
I dislike friends including me in their Check Ins	☐	☐	☐	☐	☐	☐	☐
I have never looked at the privacy settings associated with my Check Ins	☐	☐	☐	☐	☐	☐	☐

I would only Check In if I had individually vetted all the people who could see my profile	☐	☐	☐	☐	☐	☐	☐
It is concerning that my location may be passed on by someone on a social network to a third party unknown to me	☐	☐	☐	☐	☐	☐	☐
I would seek to enable tagging functionality if it was disabled	☐	☐	☐	☐	☐	☐	☐

Section 3

Attitude towards a minor using online location sharing

- Minor indicates a person under 18 years of age

1. Please indicate how strongly you agree/disagree with the following statements

	Strongly disagree						Strongly agree
Minors Checking In on social networks is harmless fun	☐	☐	☐	☐	☐	☐	☐
Minors will always find a way to subvert the rules parents set so in this case its "Better the Devil you Know"	☐	☐	☐	☐	☐	☐	☐
I would be uncomfortable with minors using Check In functionality and sharing their location	☐	☐	☐	☐	☐	☐	☐
This functionality in social networks should not be availible to minors under any circumstances.	☐	☐	☐	☐	☐	☐	☐
Minors are not fully aware of the risks of sharing their locations online.	☐	☐	☐	☐	☐	☐	☐
This functionality would be acceptable for minors to use in social networks under the proviso that parental controls are inbuilt	☐	☐	☐	☐	☐	☐	☐
Over 13’s should be able to use Check Ins unsupervised	☐	☐	☐	☐	☐	☐	☐
I would allow a minor under my supervision to Check In provided I was physically with them at the time	☐	☐	☐	☐	☐	☐	☐

Section 4

Familial Situation

Are you a parent?

- ☐ Yes
- ☐ No

If you have a child in any of the following age/gender categories please tick

	Male	Female
0 – 8	☐	☐
8 - 13	☐	☐
13 - 18	☐	☐
18 +	☐	☐

Section 5

Personal Details

Gender

- ☐ Male
- ☐ Female

Age (tick which applies)

- ☐ 18-30
- ☐ 30-40
- ☐ 40 – 50
- ☐ 50 – 60
- ☐ 60 – 70
- ☐ 70 +
- ☐

Appendix B – Frequency Tables

SmartPhoneConfidence Frequencies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I am just finding my feet	6	3.7	4.0	4.0
	I am up and running but there are still things I cannot do	30	18.5	20.0	24.0
	I can do pretty much everything I want to do	78	48.1	52.0	76.0
	I am experienced and friends often come to me for advice	36	22.2	24.0	100.0
	Total	150	92.6	100.0	
Missing	System	12	7.4		
Total		162	100.0		

$Confidence Construct Frequencies

		Responses		Percent of Cases
		N	Percent	
Confidence[a]	Not very confident at all	69	5.7%	45.4%
	Slightly unconfident	63	5.2%	41.4%
	Neither confident nor unconfident	108	8.9%	71.1%
	Moderately confident	210	17.3%	138.2%
	Very confident	765	63.0%	503.3%
Total		1215	100.0%	799.3%

Statistics

UsageTimeMonths

N	Valid	150
	Missing	12
Mean		31.59
Median		30.00

UsageTimeMonths

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	1.9	2.0	2.0
	2	2	1.2	1.3	3.3
	4	1	.6	.7	4.0
	5	2	1.2	1.3	5.3
	6	5	3.1	3.3	8.7
	7	4	2.5	2.7	11.3
	8	3	1.9	2.0	13.3
	9	2	1.2	1.3	14.7
	10	1	.6	.7	15.3
	11	1	.6	.7	16.0
	12	8	4.9	5.3	21.3
	13	1	.6	.7	22.0
	14	1	.6	.7	22.7
	16	2	1.2	1.3	24.0
	18	2	1.2	1.3	25.3
	19	1	.6	.7	26.0
	21	2	1.2	1.3	27.3
	22	2	1.2	1.3	28.7
	24	26	16.0	17.3	46.0
	25	2	1.2	1.3	47.3
	26	1	.6	.7	48.0
	28	2	1.2	1.3	49.3
	30	3	1.9	2.0	51.3
	36	26	16.0	17.3	68.7
	37	2	1.2	1.3	70.0
	38	2	1.2	1.3	71.3

	39	2	1.2	1.3	72.7
	42	1	.6	.7	73.3
	47	1	.6	.7	74.0
	48	19	11.7	12.7	86.7
	49	3	1.9	2.0	88.7
	57	1	.6	.7	89.3
	60	5	3.1	3.3	92.7
	65	1	.6	.7	93.3
	72	10	6.2	6.7	100.0
	Total	150	92.6	100.0	
Missing	System	12	7.4		
Total		162	100.0		

Parent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	63	38.9	38.9	38.9
	No	99	61.1	61.1	100.0
	Total	162	100.0	100.0	

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	76	46.9	47.2	47.2
	Male	85	52.5	52.8	100.0
	Total	161	99.4	100.0	
Missing	System	1	.6		
Total		162	100.0		

AgeBand

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 29	32	19.8	19.8	19.8
	30 - 39	74	45.7	45.7	65.4
	40 - 49	44	27.2	27.2	92.6
	50 - 59	12	7.4	7.4	100.0
	Total	162	100.0	100.0	

$Children Frequencies

		Responses		Percent of Cases
		N	Percent	
Children[a]	MaleChild_0_8	35	31.3%	55.6%
	FemaleChild_0_8	29	25.9%	46.0%
	MaleChild_8_13	6	5.4%	9.5%
	FemaleChild_8_13	8	7.1%	12.7%
	MaleChild_13_18	10	8.9%	15.9%

	FemaleChild_13_18	8	7.1%	12.7%
	Male_Over18	8	7.1%	12.7%
	Female_Over18	8	7.1%	12.7%
Total		112	100.0%	177.8%

$Attitude Frequencies

		Responses		Percent of Cases
		N	Percent	
Attitude[a]	Strongly disagree	141	8.8%	87.0%
	Disagree a little	160	10.0%	98.8%
	Neither agree nor disagree	224	14.0%	138.3%
	Agree a little	318	19.9%	196.3%
	Strongly agree	758	47.3%	467.9%
Total		1601	100.0%	988.3%

$MinorAttitude Frequencies

		Responses		Percent of Cases
		N	Percent	
MinorAttitude[a]	Strongly disagree	45	5.6%	27.8%
	Somewhat disagree	87	10.8%	53.7%
	Neither agree nor disagree	71	8.8%	43.8%
	Somewhat agree	236	29.3%	145.7%
	Strongly agree	367	45.5%	226.5%
Total		806	100.0%	497.5%

EverCheckIn*$Attitude Crosstabulation

			Attitude[a]					Total
			Strongly disagree	Disagree a little	Neither agree nor disagree	Agree a little	Strongly agree	
EverCheckIn	Yes	Count	89	136	93	182	278	778
		% of Total	5.6%	8.5%	5.8%	11.4%	17.4%	48.6%
	No	Count	52	24	131	136	480	823
		% of Total	3.2%	1.5%	8.2%	8.5%	30.0%	51.4%
Total		Count	141	160	224	318	758	1601
		% of Total	8.8%	10.0%	14.0%	19.9%	47.3%	100.0%

EverCheckIn*$MinorAttitudeCrosstabulation

	MinorAttitude[a]	Total

			Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	
EverCheckIn	Yes	Count	19	60	42	123	143	387
		% of Total	2.4%	7.4%	5.2%	15.3%	17.7%	48.0%
	No	Count	26	27	29	113	224	419
		% of Total	3.2%	3.3%	3.6%	14.0%	27.8%	52.0%
Total		Count	45	87	71	236	367	806
		% of Total	5.6%	10.8%	8.8%	29.3%	45.5%	100.0%

Parent*$Attitude Crosstabulation

			Attitude[a]					Total
			Strongly disagree	Disagree a little	Neither agree nor disagree	Agree a little	Strongly agree	
Parent	Yes	Count	51	49	87	108	329	624
		% of Total	3.2%	3.1%	5.4%	6.7%	20.5%	39.0%
	No	Count	90	111	137	210	429	977
		% of Total	5.6%	6.9%	8.6%	13.1%	26.8%	61.0%
Total		Count	141	160	224	318	758	1601
		% of Total	8.8%	10.0%	14.0%	19.9%	47.3%	100.0%

Parent*$MinorAttitudeCrosstabulation

	MinorAttitude[a]	Total

			Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	
Parent	Yes	Count	18	29	24	90	153	314
		% of Total	2.2%	3.6%	3.0%	11.2%	19.0%	39.0%
	No	Count	27	58	47	146	214	492
		% of Total	3.3%	7.2%	5.8%	18.1%	26.6%	61.0%
Total		Count	45	87	71	236	367	806
		% of Total	5.6%	10.8%	8.8%	29.3%	45.5%	100.0%

Gender*$Attitude Crosstabulation

			Attitude[a]					Total
			Strongly disagree	Disagree a little	Neither agree nor disagree	Agree a little	Strongly agree	
Gender	Female	Count	80	78	98	159	342	757
		% of Total	5.0%	4.9%	6.2%	10.0%	21.5%	47.6%
	Male	Count	61	82	125	155	411	834
		% of Total	3.8%	5.2%	7.9%	9.7%	25.8%	52.4%
Total		Count	141	160	223	314	753	1591
		% of Total	8.9%	10.1%	14.0%	19.7%	47.3%	100.0%

Gender*$MinorAttitudeCrosstabulation

			MinorAttitude[a]					Total
			Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	
Gender	Female	Count	25	30	34	110	180	379
		% of Total	3.1%	3.7%	4.2%	13.7%	22.5%	47.3%
	Male	Count	19	57	37	126	183	422
		% of Total	2.4%	7.1%	4.6%	15.7%	22.8%	52.7%
Total		Count	44	87	71	236	363	801
		% of Total	5.5%	10.9%	8.9%	29.5%	45.3%	100.0%

AgeBand*$Attitude Crosstabulation

			Attitude[a]					Total
			Strongly disagree	Disagree a little	Neither agree nor disagree	Agree a little	Strongly agree	
AgeBand	18 - 29	Count	46	55	45	69	105	320
		% of Total	2.9%	3.4%	2.8%	4.3%	6.6%	20.0%
	30 -	Count	64	78	108	164	321	735

	39	% of Total	4.0%	4.9%	6.7%	10.2%	20.0%	45.9%
	40 - 49	Count	28	17	55	61	269	430
		% of Total	1.7%	1.1%	3.4%	3.8%	16.8%	26.9%
	50 - 59	Count	3	10	16	24	63	116
		% of Total	0.2%	0.6%	1.0%	1.5%	3.9%	7.2%
Total		Count	141	160	224	318	758	1601
		% of Total	8.8%	10.0%	14.0%	19.9%	47.3%	100.0%

AgeBand*$MinorAttitudeCrosstabulation

			MinorAttitude[a]					Total
			Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	
AgeBand	18 - 29	Count	5	31	14	51	59	160
		% of Total	0.6%	3.8%	1.7%	6.3%	7.3%	19.9%

	30 - 39	Count	28	35	34	105	166	368
		% of Total	3.5%	4.3%	4.2%	13.0%	20.6%	45.7%
	40 - 49	Count	10	15	18	62	113	218
		% of Total	1.2%	1.9%	2.2%	7.7%	14.0%	27.0%
	50 - 59	Count	2	6	5	18	29	60
		% of Total	0.2%	0.7%	0.6%	2.2%	3.6%	7.4%
Total		Count	45	87	71	236	367	806
		% of Total	5.6%	10.8%	8.8%	29.3%	45.5%	100.0%