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How privacy concerns impact Swedish citizens' willingness to report crimes: a quantitative mobile phone survey

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Abstract

Purpose – The purpose of this paper is to identify whether there is a lower willingness to report a crime if a victim must hand in their mobile phone as evidence. If that is the case, the research seeks to examine whether privacy concerns and lower willingness correlate with one another and thereby investigate whether privacy concerns could lead to fewer crimes being reported and resolved.

Design/methodology/approach – A mobile phone survey was distributed to 400 Swedish adults to identify their hypothetical willingness to report certain crimes with and without handing in their mobile phones as evidence. The results were then analysed using inferential statistics.

Findings – The result suggests that there is no meaningful correlation between privacy attitudes and willingness to report crime when the handover of a mobile phone is necessary. The results of this study however show a significant lower willingness to report crimes when the mobile phone must be handed in.

Research limitations/implications – Because the chosen target group were Swedish adults, the research results may lack generalisability for other demographics. Therefore, researchers are encouraged to test other demographics.

Originality/value – This paper's contribution is the novel exploration of attitudes and behaviours regarding the combination of privacy, digital forensics, mobile phones and crime reportage. This research effort examined the problematic situation that can arise for victims of crime, the invasion of privacy when providing evidence by handing in a mobile phone to the police's forensic unit for examination.

Keywords Crime, Digital forensics, Privacy, Mobile phone

Paper type Research paper

1. Introduction

From the traditional criminal process, where only physical traces of crime have been vital evidence, digital evidence has also become a prominent part of criminal prosecutions. It is challenging to commit a crime without leaving digital evidence in today's technology-driven society causing crimes to usually leave digital evidence (Marshall, 2008; Horsman, 2021). Consequently, most crimes are committed with a connection to information technology (IT), making them IT-related (Andersson *et al.*, 2016). Fundamentally, crime reports are essential for criminals to take responsibility for their actions and not expose more people to crimes. Victims of crime can facilitate investigations and increase the probability of prosecution

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through cooperation by handing in their mobile phones to the police's forensic unit. With a mobile phone digital forensics (DF) can be carried out, which is a well-used process to collect pieces of evidence from digital devices in IT-related crime investigations (Garfinkel, 2010; Salamh *et al.*, 2021; Kävrestad, 2020). A mobile phone, arguably the most personal device, can store evidence such as photos, chats, text messages and calls, making it a terrific device for criminal investigations (Salamh *et al.*, 2021). The benefits of cooperation are primarily due to anti-forensics tools such as encryption which creates technical challenges that can be simple to address whether passwords are given (Javed *et al.*, 2021).

However, the potential negative consequence for those exposed to crime who cooperate by handing in their mobile phone is the invasion of privacy, a severe challenge in digital investigations (Nickson and Hein, 2015). The potentially harmful effect of privacy violations can influence people's willingness to report crimes to the police (Felson *et al.*, 2002). Such violations can reduce trust in law enforcement and impact people's "privacy attitudes", referring to their stance on privacy (Demertzis *et al.*, 2021). The exchange of trust among people is a vital resource that benefits society (Foa and Foa, 1980). When trust is lacking, things go in the wrong direction. The potentially harmful effect of breaking trust and thus violating privacy can influence people's willingness to report crimes to the police (Felson *et al.*, 2002). The consequence is an unknown knowledge of the number of reported crimes, leading to a "dark figure" of crime (Biderman and Reiss, 1967). The problem with unreported crimes is that the total amount is underestimated (Messner, 1984). Because of this, it can be difficult for the police to know where to spend resources. At the same time, criminals are free from arrest and prosecution, allowing them to continue breaking the law without accountability for their actions (Biderman and Reiss, 1967).

Given the problematic privacy perspective for victims of crimes, the research intended to evaluate the following research question:

RQ1. Do privacy concerns from victims of crime cause a lower willingness to report crime when handing in mobile phones is required as evidence?

The research question was established to identify whether privacy affects the willingness to report a crime when handing in a mobile phone is required. The question was based on the potential negative consequence for those exposed to crime: the invasion of privacy. The idea was to see whether privacy concerns make people less willing to hand in their mobile phones when reporting crimes to the police. The research aimed to identify whether there is a lower willingness to report a crime if one must hand in their mobile phone as evidence. If that was the case, examine whether privacy concerns and lower willingness correlate. The vision is to demonstrate whether this may be why some crimes are not reported or why evidence in the form of a mobile phone is not provided. The study studied the Swedish population. The reason was that laws and the police's approach to DF differed among countries. Hence, it would be inconsistent to research outside of Sweden. Additionally, it would be unreasonable to study a population outside Sweden because Swedish law does not apply there.

Previous research has raised several crime investigation challenges when a mobile phone is used for identifying evidence through DF. It has been argued that DF and privacy oppose one another (Nieto *et al.*, 2018). The difficulties between privacy and DF are primarily because of technical and legal challenges such as encryption and preserving victims of crime privacy in criminal investigations (Nieto *et al.*, 2018; Javed *et al.*, 2021; Halboob *et al.*, 2015). Furthermore, research has shown that IT-related crimes are reported to a lesser extent due to a lower belief in the likelihood that the police will succeed in arresting the criminal who committed the crime (Graham *et al.*, 2020). Finally, researchers have argued that it is crucial to conduct criminal investigations properly because the severe impact of IT-related crimes

on the victims goes further than solely monetary loss (Jansen and Leukfeldt, 2017). Therefore, the approach to criminal investigations must be considered where privacy is one of the aspects.

Our results suggest that the handover of a mobile phone reduces the willingness to report crimes which, in turn, increases the dark figure of crime. The collected data indicates a weak correlation between the influence of privacy concerns when handing in a mobile phone is necessary when reporting a crime. This research contributes to continued research to understand why the willingness to report crimes is reduced when the victim needs to provide their mobile phone for forensic analysis.

This paper is an extended version of the presented conference paper at the 2022 Human Aspects of Information Security and Assurance conference (Lindqvist and Kävrestad, 2022). The remaining parts of the paper are structured as follows: Section 2 describes the method used and how the analysis was made. Section 3 presents the results from the gathered data and analyses the results. Section 4 provides a discussion and an overall conclusion and recommendations for future research to end the paper.

2. Methodology

The aim of the study was met by distributing a quantitative mobile phone survey directed to Swedish citizens over the age of 18. A pilot test was implemented before the final questionnaire was sent out to ensure the quality of the survey, as suggested by Gillespie *et al.* (2016). The pilot test was distributed through convenience sampling with 24 respondents who helped clarify the text and assess the time needed to complete the survey. On average, the survey took 10 min to complete based on the respondents' feedback.

The primary data was collected in March 2022 via Pollfish, a research platform that distributes mobile phone surveys. Pollfish relies on Random Device Engagement and uses organic non-probability sampling (Rothschild and Konitzer, 2020). Pollfish allows the selection of a specific population, and the target group was specified as Swedish citizens of the age above 18. Four hundred responses were bought at a rate of $0.95 per completed survey (Pollfish, Inc, 2022). The survey was additionally distributed through Reddit. The second sample was intended to validate the results of the first sample. This data collection served as a means of triangulation, as described by Lincoln and Guba (1985). As argued by Jamnik and David (2017), Reddit is a beneficial tool for inexpensive and reliable data collection. The survey had 76 respondents, and two subreddits were used to gather respondents. Posts were published on the survey recruitment/r/SampleSize (Reddit, 2023a) and the dedicated Swedish survey thread for the/r/Sweddit (Reddit, 2023b). The posts briefly described the study, its purpose and a link to the survey.

Based on previous research recommendations, the questions were designed as a seven-point Likert scale (Alwin, 2007; Lavrakas, 2008; Menold, 2020). A non-response option was offered to avoid opinion or attitude enforcement (Alwin, 2007). The survey questions were based on Sweden's four most common types of reported crimes in 2021 (Brå, 2022). Those crimes were theft and assault, crimes against the person, criminal damage and fraud. Each category had two scenarios for each type of crime. The crime scenarios were established based on the police's description of them (Polisen, 2023). The final questionnaire questions were about privacy concerns based on Solove's (2006) taxonomy of four categories of privacy activities. Each activity had two similar scenarios regarding privacy. Two scenarios were described with varying severity to distinguish whether there was an effect on the scenarios. The survey had the four following questions:

Q1. The following statements describe criminal incidents. If you were the victim of one of these crimes, how likely is it that you would make a police report?

Q2. The following questions describe criminal incidents. If you were the victim of one of these crimes, how likely will you make a police report if you are required to submit your mobile phone as evidence? Assume that your phone will remain with the police for two days.

Q3. If you submitted your mobile phone to the police as evidence for a crime you have reported, how would then these statements fit you?

Q4. How do these statements fit you?

The likeliness of reporting a crime had the anchors 1 (*Very Unlikely*) and 7 (*Very Likely*). In contrast, the attitude towards the police and mobile phone applications was 1 (*Very Inaccurate*) and 7 (*Very Accurate*), measuring people's attitudes towards the statements of *Q3* and *Q4*. Table 1 shows the survey's four questions with corresponding statements that were answered through the previously referenced Likert scales. *Q1* and *Q2* had the same statements to indifferently measure whether there was an impact on the handover of the mobile phone.

Data analysis was conducted using inferential statistics to answer the hypothesis of whether privacy correlates to handing in mobile phones as evidence to the police (Jackson, 2015; Sahu *et al.*, 2015). Cronbach's alpha was used to measure the internal consistency of each scale, and the statements in each scale were used to compute an index value (Cronbach, 1951). The index value was calculated as the mean answer value ([statement1 + statement2 + [. . .] statement 8]/8). We analysed if handing over a mobile phone impacted significantly using a paired *t*-test. The privacy magnitude was calculated using Pearson correlation using each question's mean (Jackson, 2015). Because of the unequal sample size, Welch's *t*-test was conducted to test the data quality (Welch, 1947). The analysis allowed conclusions from the sample data to be generalised to the population on a probabilistic basis (Robson, 2002). The non-response answers were excluded from the data analysis. The conventional significance level of 95% was used in this research.

3. Results

The survey was conducted in March 2022 and resulted in 400 people responding, of whom 42% were females, and 58% were males. The four survey scales resulted in acceptable consistency, *Q1* ($\alpha = 0.913$), *Q2* ($\alpha = 0.921$), *Q3* ($\alpha = 0.891$) and *Q4* ($\alpha = 0.823$) as seen in Table 2 (Tavakol and Dennick, 2011). Thus, all statements were included in the indexes and were used for the remainder of the analysis. The descriptive statistics for each index are further shown in Table 1 below.

The paired *t*-test between *Q1* and *Q2* resulted in a significant difference $t(343) = 4.01$, $p < 0.001$ (Jackson, 2015). As such, the identified difference between *Q1* and *Q2* is statistically significant. In other words, participants are less likely to report crimes if they have to submit their cell phones for forensic analysis.

Correlation analysis was used to analyse whether privacy concerns or attitudes towards the police correlate with willingness to report crimes. The correlation coefficients of willingness to report when handing in a mobile phone against mobile privacy and police worry attitudes are illustrated in Table 3. Although the correlation tests are significant, the coefficients are too low to be considered meaningful (Jackson, 2015).

Table 1.
Set of questions with corresponding statements. 1 EUR = ~10 SEK at the time of writing

Q1 and Q2	Q3	Q4
Someone steals your wallet at an ATM	I would be worried that things would disappear on my cell phone	I would allow mobile applications to collect my contacts for backup so that they can be restored
Someone steals your motor vehicle	I would be worried that my personal information would be spread outside the police	I would allow mobile applications to collect my location, to let me see my site history
Someone sends you an unwanted nude photo via social media	I would be worried about damage to my mobile phone	I would allow personalised advertising based on my mobile purchases for the grocery store I shop at
Someone sexually abuses you	I would be worried because I do not know what the police would do with my mobile phone	I would allow my site history to be used to get restaurant suggestions
Someone writes graffiti on your motor vehicle	I would be worried because I do not trust the police	I would allow my information, such as my customer information, to be shared between telephone operators for a more effortless number transfer
Someone writes graffiti on your home	I would be worried about being without my mobile phone because I need it	I would allow you to get personalised offers based on my mobile purchases for the clothing stores I shop at
Someone defrauds you with a scam invoice of 500 SEK	I would be worried that the police would lose my mobile phone	I would allow receiving emails with surveys and competitions
Someone defrauds you with a scam invoice of 5.000 SEK	I would be worried that the police would see my messages, pictures or contacts	I would allow telemarketers to call me for offers

The same correlation analysis was used to analyse whether any specific factor strongly correlated with the willingness to report crimes. The coefficients shown in Table 4 are too low to be considered meaningful because of being between ±0.200 (Jackson, 2015).

3.1 Analysis of the result

Contrary to our expectations, the data did not support the hypothesis that privacy concerns affect handing a mobile phone to the police's DF in combination with a crime report. The result was unexpected because the idea that the mobile phone containing a considerable amount of personal information would impact the willingness to report and show a correlation that privacy concerns influence. The concern of privacy intrusion indicates no common correlation that creates a lower willingness to cooperate with mobile phones. However, the result may indicate a diverse perception of privacy. As shown by Demertzis *et al.* (2021) and Chignell *et al.* (2003), people perceive privacy differently; thus, the relationship between privacy and evidence provided by mobile phones may vary. A possible explanation of this finding is the high variation in the relationship between crime report intents, mobile phone privacy attitudes and people's attitudes towards the police.

The results further indicate that people's attitudes and behaviour regarding integrity, on average, are not so strong-willed. The reason is that the data from the survey questions tended to be close to the midpoint value. As long as the reason to share personal information with companies and authorities is for self-gain, information sharing may seem reasonable. The statements presented possible benefits to gain by sharing personal information. Furthermore, the company that collected information could have given a more targeted

Table 2. Descriptive statistics and Cronbach's alpha for indexes

Index no.	No. of respondents (n)	Mean ($\bar{x}$)	SD (σ)	Cronbach's alpha (α)
Q1	367	4.81	1.69	0.913
Q2	359	4.57	1.76	0.921
Q3	363	3.88	1.54	0.891
Q4	361	3.93	1.21	0.823

Table 3. Correlation coefficients of question indexes

Index no.	Q3	Q4
Q2	−0.055	+0.157

Table 4. Correlation coefficients of *Q3* statements

Q3 statement	Q1
I would be worried that things would disappear on my cell phone	+0.157
I would be worried that my personal information would be spread outside the police	−0.024
I would be worried about damage to my mobile phone	−0.005
I would be worried because I do not know what the police would do with my mobile phone	−0.075
I would be worried because I do not trust the police	−0.038
I would be worried about being without my mobile phone because I need it	−0.087
I would be worried that the police would lose my mobile phone	+0.086
I would be worried that the police would see my messages, pictures or contacts	−0.125

result because there are general attitudes towards varying companies. No specific company was therefore mentioned. The result does not automatically indicate that privacy and police attitudes are generally low. As explained above, people arguably differ in perceiving privacy. The mean value is close to the median value for the Likert scale and may result from polarized opinions. Possibly people can either be opinionated or careless regarding privacy.

Although the willingness to report a crime was significantly lower when the mobile phone was involved, the meaning of handing over the mobile phone can influence it. For example, data in the survey showed a higher willingness to report crimes when IT was the means. The finding could be that people perceive benefit from handing over their mobile phones for such crimes. The description of the crime was "Someone sends you an unwanted nude photo via social media", and it resulted in (M = 3.48) and (M = 3.81). Similar to how people may surrender parts of their integrity in trade for other benefits, similar reasoning can be given for evidence.

Although the willingness to report a crime was relatively low and significantly lower when the mobile phone was involved, a reason may be the confidence that the police would be able to solve the crime. For example, data in the survey showed a higher willingness to report crimes more obviously related to IT when the mobile phone is necessary, suggesting that people perceive benefit from handing over their mobile phones for such crimes. The description of the crime was "Someone sends you an unwanted nude photo via social media", and it resulted in the mean values of (M = 3.48) and (M = 3.81). Similar to how people may surrender parts of their privacy in trade for other benefits, similar reasoning can be given for evidence.

This finding suggests that depending on the type of crime and its apparent connection to IT, the police may have different requirements for when a mobile phone is required. When victims report a crime, they can voluntarily choose whether they want to hand over their mobile phones as evidence of ordinary crimes. In contrast, when the crime occurred with IT as the mean or target, the requirement may be to hand in the mobile phone as evidence. When looking at factors beyond privacy, no correlational data suggested a general reason for not handing in the mobile phone to the police. The argumentation is that the coefficients were too low to be considered meaningful. If the correlational data is disregarded and descriptive analysis is to be made, the most noticeable impact would be that people would be most worried because of the need for mobile phones with the highest mean value (M = 4.88). A reason for this could be that today's society is so digitalised that one's everyday life is simplified and that the need for a mobile phone is comprehensive. This finding supports the shortening of the analysis to reduce the time victims of a crime spend without their mobile phones to decrease their worries. By decreasing the time taken for analysis, victims of crime may experience that everyday life is not affected negatively, increasing their willingness to report crimes.

4. Discussion

This paper reports whether privacy concerns influence the willingness to report a crime when it is necessary to hand in a mobile phone for evidence to the Swedish police DF unit. The study surveyed 400 Swedish adults as the primary data source through a mobile phone survey. To test the data quality of the collected responses, the survey was also distributed through Reddit, an internet website for social forums. As shown in Table 5, the two samples did not significantly differ regarding willingness to report crime when handing over the mobile phone to the police (*Q2*) $t(111.23) = 1.19$, $p = 0.24$, or privacy attitudes regarding the mobile phone (*Q3*) $t(92.15) = 1.71$, $p = 0.09$. A significant difference was shown between

willingness to report crimes (*Q1*) $t(198.09) = -4.28$, $p < 0.001$, and worry concerning handing over the mobile phone to the police (Q4) $t(111.77) = 4.64$, $p < 0.001$. A possible explanation for this finding could be that Reddit mainly consists of young male users (Proferes *et al.*, 2021). It is, therefore, not fully equal to the Pollfish sample.

The sample from Reddit indicated a similar correlational coefficient between *Q2* and *Q3* (−0.176). The data from the study indicate that different groups may differ in attitudes and behaviours regarding privacy and the police, as argued in the analysis. However, it was beyond the scope of this article to explore groupings of people regarding privacy and police attitudes.

Research ethics unavoidably play a role when involving humans as subjects, enforcing the obligation to consider ethical treatment (Gillespie *et al.*, 2016; Fowler, 2013). The involvement may inadvertently harm them, not solely physically, by embarrassing them, violating their privacy and other undesirable harmful effects. Those undesirable effects are essential to keep in mind when conducting research. However, implementing an adequate quantitative survey when a platform is used as a distribution method is cumbersome because it is beyond the control of how the company operates. Pollfish complies with applicable GDPR and allows respondents to opt-out (Pollfish, 2022). The respondents received compensation for their time in carrying out the study, and the purpose of the study was to benefit the judiciary. For obvious ethical considerations, the work sought not to explore children for several reasons (Loue, 2002).

As for the limitations, it can be assumed that most respondents have never been in a position where they had to decide whether to submit their mobile phones for a crime report or not. Most participants would likely give an opinion without having complete insight into the scenario and thus affect the non-generalisable situation. Another limitation was that users registered with Pollfish only had the opportunity to participate in the study, excluding people without the service. However, the use of Pollfish verified that respondents owned a mobile phone. Additionally, participants that are particularly interested in the topic take the time and trouble to respond. In contrast, uninterested may avoid the trouble of conducting the survey and thus, it is challenging to understand respondent bias (Andrade, 2020). Additionally, as a limitation, the chosen target group were Swedish adults, leading that the research results may lack generalisability for other demographics.

The result of not proving that privacy is a prominent factor that influences attitudes and behaviour regarding the handover of evidence suggests not automatically an absent contribution. On the contrary, the study indicates that further research is needed. As a result, it shows a lower willingness to report crimes when handing over a personal mobile phone, revealing a real negatively impacting problem.

The findings can be compared to the results of earlier studies that reported that intentions increase with the severity of the crime (Graham *et al.*, 2020), both for regular crime reports and crime reports with mobile phones as a requirement for evidence. The most apparent evidence of this claim is the significant difference in the monetary value of a

	Pollfish			Reddit			Welch's *t*-test		
Index no.	*N*	*M*	*SD*	*N*	*M*	*SD*	*t*	*df*	*p*
Q1	367	4.81	1.69	73	5.39	0.87	−4.28	198.09	<0.001
Q2	359	4.57	1.76	71	4.33	1.51	1.19	111.23	0.24
Q3	363	3.88	1.54	76	3.59	1.69	1.71	92.15	0.09
Q4	361	3.93	1.21	73	3.10	1.27	4.64	111.77	<0.001

Table 5. Descriptive statistics and Welch's *t*-test

fraudulent invoice. A paired t-test between the loss of 500 and 5,000 Swedish kronor resulted in $Q1$ $t(392) = -5.9$, $p < 0.001$, and for $Q2$ $t(382) = -7.26$, $p < 0.001$, which provides strong evidence that the severity of the crime impact willingness to report significantly. As seen in Table 2, the likelihood of reporting a crime was relatively low ($M = 4.81$), whereas five was "quite likely". Similarly, $Q2$ was close to "quite likely" ($M = 4.57$). Nonetheless, the finding shows a significant difference in the likelihood of reporting a crime, concluding that handing in a mobile phone impacts. Compared to previous studies, this research examined the problematic situation that can arise for victims of crime, in this case, the invasion of privacy when providing evidence by handing in a mobile phone to the police for DF examination. The research explored attitudes and behaviours with privacy as the main issue and provided future directions for research within this area. The findings, in summary, contrary indicate that people do not see privacy as a common hindrance when handing in a mobile phone. The findings suggest that there may be a difference between subgroups of people regarding which can be used by the scientific community for future exploration.

5. Conclusion

This paper aimed to see whether there was a difference in the tendency to report a crime when the handover of a mobile phone was necessary as evidence. If that was the case, the paper further aimed to investigate whether privacy concerns caused that difference. By distributing a mobile phone survey to Swedish adults, attitudes and behaviours were measured through Likert scales. The results were then analysed using inferential statistics, which identified a significantly lower willingness to report crime when the handover of a mobile phone is necessary. However, the statistical analysis identified no meaningful correlation between privacy attitudes and willingness to report crime when the handover of a mobile phone is necessary. Furthermore, the study found no direct correlation between several reasons for concern if the police obtained the mobile phone. Influencing factors beyond privacy that may lower the willingness to hand in a mobile phone when a crime report is made was the apparent connection to IT. This may be due to the belief in the meaning of the evidence, increasing the willingness to report that type of crime. Moreover, the findings suggest that the worry of being without one's mobile phone is the most prominent factor when the police have a mobile phone during a criminal investigation.

The contribution of this research is the exploration of attitudes and behaviours regarding the combination of privacy, DF, mobile phones and crime reportage. The research addresses that the willingness to report crimes contributes to a dark figure in statistics and explores possible reasons for the phenomenon. The results and methodology can support future studies by providing insight into what the results can yield and how research can be done. Subsequently, this paper can help create new ways and ideas for conducting research in this field of research within different demographics or aims. Compared to previous studies, this research examined the problematic situation that can arise for victims of crime, in this case, the invasion of privacy when providing evidence by handing in a mobile phone to the police for DF examination. The research explored attitudes and behaviours with privacy as the main issue and provides future directions for research within this area. The findings, in summary, contrary indicate that people do not see privacy as a common hindrance when handing in a mobile phone. The findings suggest that there may be a difference among subgroups of people regarding which can be used by the scientific community for future exploration.

Future studies could continuously assess how privacy influences behaviour and attitudes. Research can be conducted with a larger data sample to strengthen the findings of this research. Future work can also assess the extent to which other digital devices and

scenarios differentiate. Furthermore, future studies can compare cybercrimes against IT-related crimes to identify whether there is a differentiation in the willingness to hand in a mobile phone. Another possible direction is measuring the privacy concerns and exploring the differences between ages or other types of subgroups.

Moreover, future research can provide insight into victims of crime by doing interviews. An interview study can determine the considerations when reporting a crime and handing in the mobile phone. Examining what factors affect victims' willingness to cooperate by providing digital evidence can be further clarified. Such work can contribute to developing best practices to ensure appropriate approaches. Additionally, the police's forensic unit can provide further observations on how victims of crime proceed when digital evidence is provided.

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