Privacy in Times of COVID-19: A Pilot Study in the Republic of Ireland

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ABSTRACT

Contact tracing apps used in tracing and mitigating the spread of COVID-19 have sparked discussions and controversies worldwide with major concerns around privacy. COVID Tracker app used in the Republic of Ireland was praised in general for the way it addressed privacy and was used as baseline for other contact tracing apps worldwide. The success of the app is dependent on the general public uptake, hence their voice and attitude is the one that really matters. This paper focuses on developing a survey and the methods aiming to examine the attitudes toward privacy during COVID-19 of the general public in the Republic of Ireland and their impact on the uptake of the COVID tracker app. Various privacy models are used and health belief model as well in this purpose. A pilot study with 286 participants show a change in attitude towards privacy during COVID-19 pandemic, with more people willing to share their data in the interest of saving lives. However, privacy attitudes are shown to have impacted the adoption of the app in Ireland.

CCS CONCEPTS

• **Security and privacy** → **Human and societal aspects of security and privacy**; **Privacy protections**.

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KEYWORDS

Privacy, COVID-19, tracker app, health belief model, privacy segmentation index

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1 INTRODUCTION

Contact tracing apps used in tracing and mitigating the spread of COVID-19 have sparked discussions and controversies worldwide. One of the major concerns in relation to these apps are around privacy. A comprehensive survey of contact tracing apps can be found in [1]. There is a particular emphasis in the survey on the security and privacy concerns that were raised in relation to these apps. Ireland was praised for the design of its COVID tracker app, and the transparency through which NearForm[1] and the Irish Health Services (HSE) addressed privacy issues. The HSE provided a considerable amount of information on their website regarding the data processing, and made the data protection impact assessment (DPIA) of the app available to the public. The source code of the app is also available as open source and can be examined. However, concerns about privacy were raised for instance by the Irish Council for Civil Liberties due to lack of transparency from Apple and Google's side in terms of their involvement in the tracker app[2]. A research study also revealed issues with the DPIA and some of the documentation, some of the statements in the DPIA being shown as rather assumed

[1] https://www.nearform.com/
[2] https://www.iccl.ie/2020/experts-issue-pre-release-report-card-on-the-hse-covid-19-tracker-app/

than demonstrated [8]. This paper focuses on a pilot study conducted in the Republic of Ireland aimed at examining the privacy attitudes of the general public in the Republic of Ireland, the differences in attitudes before and during the COVID-19 pandemic and how these attitudes relate to the adoption of the COVID tracker app. In the end, the success of the app is dependent on the adoption rate of the general public, hence the importance of this research. Central to the design of the research study is a questionnaire that was built using a mix of privacy models. Health Belief Model was also used in order to understand the variety of factors (including the privacy attitudes) that might influence the uptake of the COVID tracker app in the Republic of Ireland. The questionnaire was distributed online through various channels, mainly social media channels. The results of this pilot study that gathered 286 full responses are analysed and presented in this paper. Noteworthy is the fact that this pilot study was used to refine a privacy survey in times of COVID-19 aimed to be released nationally. The pilot study and the further analysis on the national survey is complemented by a sentiment analysis on data collected from public Twitter accounts belonging to Twitter users living in Ireland. We have presented the results of this analysis in [9]. The analysis on the Twitter data shows that the public sentiment towards COVID tracker app is in general negative, due to various reasons that include privacy concerns, but also lack of transparency in communication regarding the efficacy of the application and the general user experience with the app. The results of the pilot study are around the same lines. Privacy concerns seems to influence the adoption of the app, however, there is an increased willingness to share personal data in these times as compared to the normal time with the goal of saving lives. The privacy awareness seems to have increased though, with many people reading the privacy policy of the app.

COVID tracking apps have generated considerable research. Some research studies used surveys as it is the case of this paper to capture people's willingness of adopting these apps and their opinion in relation to them. The surveys were usually performed at a country level (e.g. a survey in France [2], or UK [14], etc.). In Ireland, a similar study was performed prior to the release of the app [12]. The study showed that 54% of the people in Ireland expressed willingness to use the COVID tracker app. Concerns were however raised regarding privacy and security issues. More recently, a sentiment analysis study was published in relation to the Irish COVID tracker app [13]. The study performed a manual sentiment analysis on the Google Play comments related to the app. The study was focused however more on the usability aspect of the app, not on security or privacy aspects.

This paper is organized as follows. Section 2 presents the research methods employed in the study, while section 3 analyses and discusses the results of the pilot study. Conclusions are drawn in the last section.

2 RESEARCH METHODS

A questionnaire was built to assess the privacy attitudes in COVID-19 times of the general public living in Ireland. The questionnaire was uploaded online using Google Forms. Data collected is covered by the Dublin City University Google apps agreement which includes data protection assurances. The survey has been approved by the National Research Ethics Committee of the Health Research Board. This paper focuses on a pilot study that was conducted prior to the national release of this privacy survey. The questionnaire was built following several models that we have tested for their suitability to provide us with the questions to the following 2 main research questions:

1. Has the general Irish public attitude towards privacy changed during the COVID-19 pandemic?

2. Do privacy attitudes influence the adoption of the COVID tracker app?

The models used were Westin's privacy segmentation index (PSI) [6], privacy attitude questionnaire (PAQ) [3] and Health Belief Model (HBM). Alan Westin analysed more than 120 privacy surveys and conducted himself over 30 privacy studies and he has developed a model, called Privacy Segmentation Index (PSI) that allows for the classification of individuals in three privacy classes, namely: privacy unconcerned, privacy pragmatist and privacy fundamentalists. His model was used or extended by countless privacy studies(e.g. [7, 11],), including ones that focused on health data. Privacy studies have been conducted across the years to understand people's attitudes toward privacy, but also to understand the impact of these attitudes on their behaviour when using various services. The focus nowadays is on digital services, whether it is about online social networks, mobile apps in general, e-commerce, online health services, etc. The classification of the individuals in the aforementioned privacy classes is done on the basis of the answers to the following statements with options of response from "Strongly disagree" to "Strongly Agree" on a 5 point LIKERT scale:

- *Consumers have lost all control over how personal information is collected and used by companies.*
- *Most businesses handle the personal information they collect about consumers properly and confidentially.*
- *Existing laws and organizational practices provide a reasonable level of protection for consumer privacy today.*

Privacy fundamentalists agree with statement 1 and disagree with statements 2 and 3. The privacy unconcerned disagree with statement 1 and agree with statements 2 and 3. The remaining participants are privacy pragmatists. PAQ has 32 questions that cover 4 dimensions of privacy referring to the willingness to: share personal information, to be monitored, to be exposed and to be protected. Every dimension is covered by 8 questions. We have selected 2 questions for each dimension as described next.

For the *exposure* dimension:

- No organization or person should disseminate personal information about me without my knowledge
- I'd object to my photograph appearing in a public place without my permission

For the *willingness to be monitored* dimension:

- Video cameras should be used in public places to improve public safety and security
- I respond to telephone marketing surveys

For the *interest in protection* dimension:

- I frequently question why I'm providing personal information
- I like to change my passwords frequently for security reasons

For the *willingness to share personal information* dimension:

- I frequently question why I'm providing personal information
- I like to change my passwords frequently for security reasons

The 5 point Likert scale was used for the responses to the above questions (from Strongly disagree to Strongly agree). The aim was to use these models to assign a general privacy profile to the respondents of the survey and then to examine the various behaviours and attitudes depending on this profile. For instance, in the questionnaire we have asked the respondents if they are willing to share their personal data during the pandemic with a couple of predefined actors (e.g. HSE) in the interest of saving lives. The same question was asked for normal circumstances. The goal was to see if there was any change in attitude and to see for which of the privacy profiles this change is more prevalent. Other questions were added to the questionnaire that aimed to examine if the respondents are reading their privacy policies in general and if they read the privacy policy of the COVID tracker app. HBM was used as a more complex model in analyzing various factors (that included privacy attitudes) influencing the adoption of the COVID tracker app. HBM is used on a large scale in determining various factors and their influence in the adoption of a health behavior. It has been used in COVID-19 related research to understand for instance coronavirus infection risk determinants [4]. Health belief model explores four dimensions:

- perceived threat, measured through the following question: How concerned are you about getting infected with COVID-19?
- perceived benefits measured through one question that looked at the respondents' belief in relation to the ability of the app to control the spread of COVID-19: I do not think the application is helpful in controlling the virus
- perceived barriers that were considered the privacy concerns: I am worried about the implications this application will have on my privacy and data protection
- cues to action measured through the familiarity with the app and its role: I am familiar with the HSE COVID Tracker application and its role. (strongly disagree to strongly agree)

We then analysed the influence of these dimensions on the adoption of the COVID tracker app that was considered in this case a health behavior. Demographic data was also collected in the questionnaire. The questionnaire was released on 27/08/2020 and was open for one full month. It had a limited distribution as this was a pilot study used to refine the final privacy survey in COVID-19 times that was released afterwards in Ireland. Next section presents the analysis of the data collected in this pilot.

3 DATA ANALYSIS

3.1 Participants demographics

129 (50%) of the participants are male and 126 (48.84%) are female, 2 persons prefer not to say and 1 person has gone through a gender transformation. Most (72.48%) of the participants come from Dublin. Non-Dublin participants are distributed among 20 other counties. The participants were well-educated, with 92 (35.66%) persons owning a Master's degree, 67 (25.97%) persons owning a Doctorate and 57 (22.09%) owning a Bachelor's degree. The rest of participants finished secondary school or have vocational training. Hence, the pilot reached out mostly or was answered by highly educated people. The gender distribution was however quite even.

3.2 Classification of the participants based on PSI

As described in section 3 we used Westin's PSI to classify the respondents in 3 classes: privacy fundamentalists, privacy unconcerned and privacy pragmatists. These classes are defined as in [6] as follows:

- Privacy Fundamentalists: *The people in this group are the most protective of their privacy. They feel companies should not be able to acquire personal information for their organizational needs and think that individuals should be proactive in refusing to provide information.*
- Privacy Pragmatists: *This group weighs the potential pros and cons of sharing information, deciding whether it makes sense for them to share their personal information.*
- Privacy Unconcerned: *They are the least protective of their privacy and feel that the benefits they may receive from companies after providing information far outweigh the potential abuses of this information.*

The distribution of the participants in the pilot study in the 3 privacy classes defined by Westin is as follows: 57% of all participants are privacy pragmatists, 27.5% are fundamentalists, and the remaining 15.5% are privacy unconcerned. The distribution obtained is similar to the one obtained by Westin in his privacy studies, but it is also similar to more recent studies such as the one presented. This can be seen in Table 1.

3.3 PAQ analysis

As mentioned in section 3, an adapted PAQ was included in our questionnaire. The initial PAQ uses 8 questions to assess each of the 4 privacy dimensions: exposure, willingness to be monitored, interest in protection and willingness to share personal information. We have selected 2 for each dimension, a 5 point Likert scale being used. As we did not adopt the original PAQ, we assessed the internal consistency of these 8 questions by calculating Cronbach's alpha. A value of 0.808 was obtained which suggests a good internal consistency.

On the basis of the pilot study participants responses, the average score were calculated for each dimension and they are summarized in Table 2. Note that a lower score indicates a higher concern. For instance, the table shows that the participants in the pilot are more open to sharing their personal information, showing less willingness for being monitored. Moreover, the most sensitive dimension is the exposure. Figure 1 shows the average score for each dimension per privacy class as defined by Westin. Remarkable is the sensitiveness of the fundamentalists to being monitored and the fact that they are not willing to share personal information.

Table 1: Participants classification including comparison with other studies

Study	Fundamentalist group	Pragmatist group	Unconcerned group
Westin studies (1995-1999)	25%	55%	20%
Westin Mid 2000	25%	63%	12%
Westin Late 2001	34%	58%	8%
Westin Late 2003	26%	64%	10%
Motiwalla et al. (2016)	27%	69%	6%
Our pilot study	27.5%	57%	15.5%

Table 2: PAQ average scores per dimension

Dimension	Average score	Min score	Max score
Exposure	0.64	0	3.5
Willingness to be monitored	1.99	0	4
Interest in protection	1.45	0	4
Willingness to share personal information	2.09	0	4

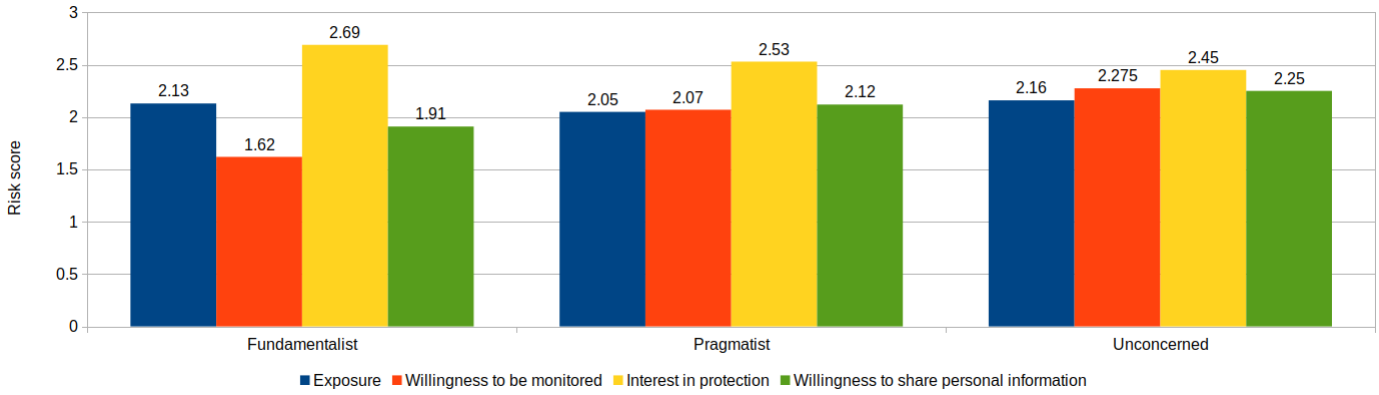

Figure 1: PAQ scores per privacy class

3.4 Changes in privacy attitudes in times of COVID-19

The results summarized in Figure 2 are clearly showing that the participants are more willing to share their data during COVID-19 pandemic. The figure summarizes the answers of the survey participants to the following 2 questions:

- Would you agree to share your mobile data (data stored or related to your mobile device) with the government and relevant institutions to help defeat COVID-19?
- Would you agree to share your mobile data (data stored or related to your mobile device) with the government and relevant institutions to help defeat COVID-19?

Adjacent questions clarify the institutions (i.e. Government, health authorities, public apps sharing individual data, public apps sharing anonymized data) they are willing to share their data with and the type of data they are willing to share (personal details - name, gender, age-, exact mobile geo-location data, anonymized mobile geo-location data (not exact location, but within a range), health status data, contact list, other). Overall, the answer to "Agree" increases dramatically from 12% to 61% which shows significant improvement in privacy attitude during the pandemic. The statistical significance of this improvement was demonstrated through a paired T-test (P-value = 1.23E-33). As expected, the people classified as unconcerned are the most willingly to share their data, while those classified as fundamentalists are the least interested ones. Regardless of the class they belong to, there is a definite increase in the willingness to share their data before and during the COVID-19 pandemic. One of the questions included in the questionnaire related to how often the participants would read the privacy policy. The results are summarized in Figure 3. The results are not really surprising, overall only 20% of the respondent are quite conscious about reading the privacy policies. Studies have shown that in general users do not read the privacy policies with most of the users skipping them [5]. This happens despite of users claiming to be pretty concerned about their privacy as it is show for instance in a recent study conducted in Europe [10]. When asked if the users read the COVID tracker app privacy policy, 59% stated that have read it, which is quite a high number as compared to 20%. Hence,

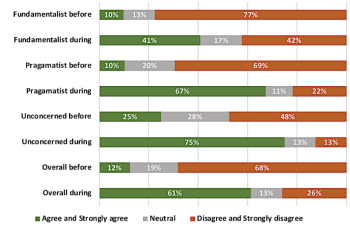

Figure 2: Willingness to share their data before vs during the pandemic

during COVID-19 times show a shift in attitude, they seem to be more willing to share their data in the interest of saving lives, but they also seem to increase their awareness about privacy, they want to be more informed.

3.5 COVID tracker adoption and the role of privacy. HBM results

55% of the participants in the pilot study states they are using the COVID tracker app, with the rest stating they are not using it. Figure 4 shows the distribution of responses per the 3 privacy classes. Unsurprisingly, the least adoption rate of the app is among the privacy fundamentalist group. This clearly shows that privacy is indeed an influencing factor in the adoption of the COVID tracker app. The HBM analysis demonstrated a significant influence of the barrier (the privacy attitude), cue to action (the familiarity with the app and its role), and perceived benefits on the behavior of the users in terms of adopting or not the app. The perceived threat (concern of getting infected with COVID-19) was demonstrated not to have a significant influence on the adoption of the app.

3.6 Lessons learnt from the pilot study

The results of the pilot were presented for review in a private project stakeholders webinar that included HSE, Central Statistic Office Ireland, Irish Council of Civil Liberties and others. Our research is part of a Science Foundation Ireland COVID-19 rapid response grant and a rapid communication of the results and feedback from the stakeholder were of utmost importance. Following the analysis presented and the feedback from the stakeholders we have updated the questionnaire that was further used in a national survey on privacy in COVID-19 times. Some major changes included removing the PAQ model as the questions were not deemed that representative for the Irish landscape. In addition, the analysis did not reveal other insights that could not be captured through the PSI classification for instance and the other questions of the survey. Additional questions were added to support HBM, especial the perceived threat dimension. Other modifications focused on improving the formulation of the questions to be more accessible to the large audience and easier to be understood.

4 CONCLUSION

This paper presented the design of a pilot study conducted in the Republic of Ireland that focused on examining the privacy attitudes in COVID-19 times, changes in attitudes and their role in the adoption of the COVID tracker app. The pilot study is based on a questionnaire that was released online and gathered 268 responses. The analysis of the responses indicates that in general people in Ireland are quite protective of their privacy (with many being classified as fundamentalists and the majority being privacy pragmatist). A change in attitude towards privacy is shown, namely the people seem to be more willing to share their personal data during these times in the interest of saving lives. However, they are willing to share their data through the COVID tracker app in an informed manner, with the majority reading the app's privacy policy. Hence, their attitude that can be perceived as privacy relaxation (in the sense of their considerable increased willingness to share their data) seems to be in fact due to the "lifesaving potential" of sharing their data, while privacy awareness seems to have increased during these times. The results also indicate that privacy concerns influence the adoption of the COVID tracker app, together with other factors that relate to the efficacy of the app, and the understanding of its role. The ultimate goal of the pilot was to refine the questionnaire and methods used in a national survey on privacy in COVID-19 times. Future work will focus on presenting the national survey and will extend the models used in the current analysis. The analysis of the HBM will be extended to consider the influence of the demographic characteristics as well.

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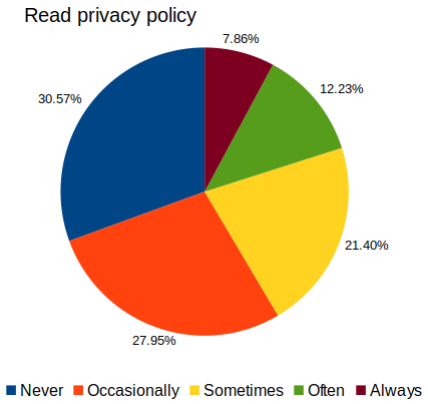

Figure 3: The distribution of responses to the question How often do you read mobile apps' privacy policy?

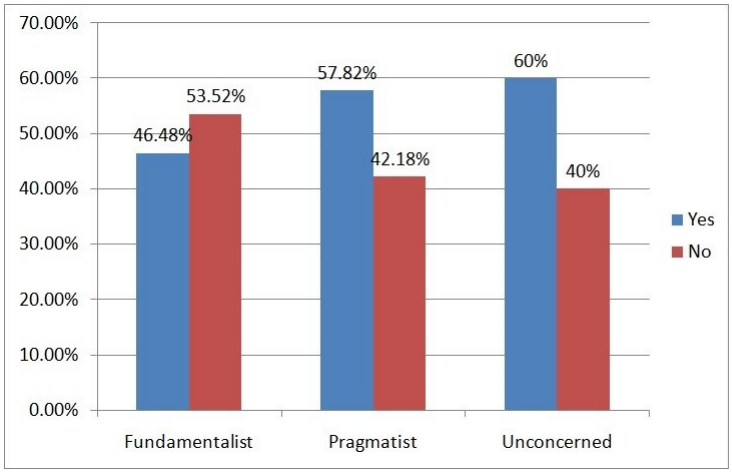

Figure 4: COVID tracker app adoption rate per privacy class

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