

# **Public attitudes towards privacy in COVID-19 times in the Republic of Ireland: a pilot study**

Malika Bendeche <sup>a,b,c,\*</sup>, Pintu Lohar <sup>a</sup>, Guodong Xie <sup>a</sup>, Rob Brennan <sup>a,c</sup>,  
Ramona Trestian <sup>g</sup>, Edoardo Celeste <sup>a,f</sup>, Kristina Kapanova <sup>a</sup>, Evgeniia  
Jayasekera <sup>e</sup>, and Irina Tal <sup>b,c</sup>

*\* corresponding author*

*<sup>a</sup> ADAPT–Science Foundation Ireland Research Centre*

*Email: {pintu.lohar, guodong.xie, kristina.kapanova}@adaptcentre.ie*

*<sup>b</sup> Lero–Science Foundation Ireland Research Centre for Software*

*<sup>c</sup> School of Computing, Dublin City University, Ireland*

*Email: {malika.bendeche, rob.brennan, irina.tal}@dcu.ie*

*<sup>d</sup> School of Computer Science and Statistics, Trinity College Dublin, Ireland*

*<sup>e</sup> School of Computing, National College Ireland, Ireland*

*Evgeniia.Jayasekera@ncirl.ie*

*<sup>f</sup> School of Law, Dublin City University, Ireland*

*Email: edoardo.celeste@dcu.ie*

*<sup>g</sup> Faculty of Science and Technology, Middlesex University London, UK*

*Email: R.Trestian@mdx.ac.uk*

# Public attitudes towards privacy in COVID-19 times in the Republic of Ireland: a pilot study

This research focuses on designing methods aimed at assessing Irish public attitudes regarding privacy in COVID-19 times and their influence on the adoption of COVID-19 spread control technology such as the COVID tracker app. The success of such technologies is dependent on their adoption rate and privacy concerns may be a factor delaying or preventing thus adoption. An online questionnaire was built to collect: demographic data, participant's general privacy profile using the Privacy Segmentation Index (PSI) which classifies individuals into 3 groups (privacy fundamentalists, pragmatists, and unconcerned), and the attitudes toward privacy in COVID-19 times. The questionnaire was shared via websites and social networks. The data was collected between 27/08/2020 to 27/9/2020. We received and analysed 258 responses. The initial pilot study found that almost 73% of the respondents were pragmatists or unconcerned about privacy when it came to sharing their private data. Comparable results were obtained with other privacy studies that have employed PSI. The pilot indicates a huge increase, from 12% pre-pandemic to 61% during the pandemic, of people willing to share their data. The questionnaire developed following this study is further used in a national survey on privacy in COVID-19 times.

**Keywords:** COVID-19; privacy; pandemic; attitude; information, data.

## 1. Introduction

The spread of the COVID-19 novel coronavirus and its rapid escalation into a pandemic in the early months of 2020 marks the first truly major, widespread global health emergency crisis. Governments worldwide attempt to control the spread of the virus using different approaches. Digital technologies play contrasting roles in this context.

In the weeks following the declaration of COVID-19 as a pandemic by the World Health Organization, several companies and countries have unveiled plans to implement a wide range of digital technologies to limit the spread of COVID-19, including contact tracing apps to track and mitigate the spread of COVID-19<sup>1</sup>.

Several countries have succeeded in containing the COVID-19 pandemic using tracking apps. Examples of such countries include South Korea (COVID-19, 2020), Singapore (Lee Vernon, 2020), and China (Allam, 2020). However, these intrusive models could not be adopted in the EU. Firstly, health data are considered as a particularly sensitive category of data, which the General Data Protection Regulation (GDPR) subjects to

---

<sup>1</sup> <https://www.irishtimes.com/business/technology/how-you-and-your-technology-can-help-fight-covid-19-1.4229806>

specific additional guarantees (GDPR, Art. 9). Secondly, the recent case law of the European Court of Justice held that the bulk collection of personal data, including communication metadata, violates the data protection rights of individuals by failing to represent a proportionate measure that minimizes the data collected in light of the purposes of the data processing (Celeste, 2019). A general tracking of people's location in conjunction with processing of their health data would amount to a system of mass surveillance that affects sensitive aspects of our personal lives. Therefore, following guidelines from the EU Commission<sup>2</sup> (2020), many European countries have adopted different approaches where their contact tracing apps use Bluetooth (rather than more precise location data) to identify other smartphones that come into proximity with the phone of an infected person, then notify them through the app.

Many research studies have raised security and privacy concerns about using contact tracing (e.g., (Andrew Crocker, 2020) (Granick, 2020), (Cho, 2020)) as well as broader concerns about efficacy (e.g., (Soltani, 2020)). There is currently significant public discussion about the tensions between effective technology-based contact tracing and the privacy of individuals across all EU countries (Bradford et al., 2020).

While discussions around privacy are old as mankind, these contact tracing apps may have hit a sensible spot due to the mass surveillance model followed in some of the countries mentioned above. The interesting thing is though how the people will react during the pandemic, will they be less sensitive to privacy issues and more concerned about the general public health? Alan Westin, a prominent figure in privacy research and considered by many the father of modern data protection law, defined privacy as: *“the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others”* (Holvast, 2007). When we talk about digital privacy, the only thing necessary to be clarified in this definition is the type of information, namely digital information. Alan Westin analysed more than 120 privacy surveys and conducted himself over 30 privacy studies and he has developed a methodology, called Privacy Segmentation Index (PSI) that allows for the classification of individuals in three privacy classes. His studies and the developed methodology are on the basis of many other privacy studies conducted across the years (Kumaraguru, 2005). His studies are used as a comparison baseline for many privacy studies including very recent ones (e.g. (Malheiros et al., 2013), (Motiwalla et al., 2016)) and they are also on the basis of newly proposed or adapted methodologies. For example, (Elueze et al., 2018) proposed a new methodology that extends Westin classes and that is dedicated to older adults, while (Kuzmanovic et al., 2020) adapted Westin's methodology to a study that looked at the personal privacy on online social networks. 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.

In these pandemic times, different survey-based studies have been conducted across different EU countries to capture people's attitudes toward the use of COVIDtracking apps to help contain the virus including Denmark (Jansen-Kosterink, 2020), France (Altmann, 2020), The UK (Wiertz, 2020), and Ireland (O'Callaghan, 2020). In their

---

<sup>2</sup> Commission Recommendation (EU) 2020/518 of 8 April 2020 on a common Union toolbox for the use of technology and data to combat and exit from the COVID-19 crisis, in particular concerning mobile applications and the use of anonymised mobility data. <http://data.europa.eu/eli/reco/2020/518/oj>

study, O’Callaghan *et al.* have examined barriers and levers to the use of a contact tracing app in Ireland. The results of their survey study revealed that the Irish expressed high levels of willingness (54%) to download the tracking app to augment contact tracing. However, some concerns were also raised regarding the privacy and data security of the tracking app and also about its efficacy.

The focus of our research is on the privacy element and its influence in adopting the COVID tracker app in particular and other technologies in general.

This paper makes the following contributions:

1. designing a study able to capture attitudes toward privacy, changes in attitudes toward privacy in COVID-19 times and the impact of these attitudes on the adoption of technological solutions designed to help with the management of this health crisis.
2. presenting and analysing an initial set of results of the pilot study conducted prior to the national release of the national survey on privacy in COVID-19 times.

The rest of the paper is organised as follows; in the next section, we will explain our research design. Section 3 will detail our analysis and findings. In Section 4, we will discuss our results. We will finish up with a conclusion and what we plan to do next in Section 5.

## **2. Research Study Design**

The research study is based on an online questionnaire. There are three main stages of the methodology designed and employed in the pilot study: the building or creation of the questionnaire, data collection and data analysis.

### **2.1. Questionnaire Creation:**

The questionnaire is structured in three parts: demographics, privacy profiles and privacy attitudes during COVID-19. The first part collects demographic data following the guidelines from (Hughes, 2016) and the Central Statistics Office (CSO) Ireland that is one of the stakeholders of the project. There were 4 demographic questions aimed to collect data about: gender, age, county and level of education.

The second part aims to build a general privacy profile of the participants using PSI, the methodology developed by Alan Westin. The choice was motivated by the extensive use of this methodology/theoretical framework in the literature in various contexts (e.g. consumer privacy, health information privacy, e-commerce, mobile data privacy, etc.) that also facilitates the comparison with other privacy studies.

Westin’s methodology classifies individuals into 3 groups: privacy fundamentalists, pragmatists and unconcerned. 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:

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

According to Westin’s classification, 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. From now on, we refer to them simply as “fundamentalist”, “pragmatist” and “unconcerned”.

In this second part of the questionnaire, specific questions are added to evaluate the perceived risk of the users when using mobile apps as COVID tracker app falls under this category. The questions were adapted for mobile apps from a study that performed a survey on privacy concerns in an online environment (Tsai et al., 2006). On the basis of these questions, a risk score is calculated that is quantifying the perceived risk of the users when using mobile apps. The survey by Tsai et al. (2006) is also using Westin’s PSI. This second part of the questionnaire comprised 19 questions: 3 PSI related, 2 questions of control verifying if the participants in the survey own a smartphone and how knowledgeable are they about dealing with mobile apps, 6 questions that related to the risk score and 8 questions that were adapted from the privacy attitude questionnaire (PAQ) proposed by Chignell (2003). The initial 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 for each dimension, however, the analysis of the results showed that these questions did not contribute with any additional insights. Most probably, the number of questions were too low for each dimension. Note that these questions were removed from the final questionnaire that will be used for the national survey on privacy in COVID-19 times.

The third part of the questionnaire aims to capture attitudes toward privacy in COVID-19 times. This includes questions related to sharing personal data in the interest of saving lives, what type of personal data they are willing to share and to whom they are willing to share (e.g. Government, Health services, private companies, etc.) Then it contained a considerable number of questions related to COVID-19 tracker app and its usage, and also questions that relate to possible influencers on the attitudes (e.g., the concern of getting infected with COVID-19). This third part of the questionnaire comprised 20 questions.

## **2.2. Data Collection:**

The questionnaire created was built in a Google Forms online anonymous survey. The target population of the survey is the general Irish public over 18 years of age. The survey was distributed using the following channels: the social media of the universities and research centres involved, ADAPT<sup>3</sup> and Lero<sup>4</sup>, and directly by researchers using social media platforms (e.g., LinkedIn, Twitter, Facebook). In this pilot study, the survey had a limited distribution as the pilot is an intermediate step in the design of a national privacy survey in COVID-19 times.

Data collected is covered by the DCU Google apps agreement which includes data protection assurances. The survey has been approved by the National Research Ethics Committee of the Health Research Board.

The data analysis stage is detailed in the next section that presents the results of the pilot study.

## **3. Results Analysis**

In this section, initially, we analyse the data collected in the pilot study. First, we perform the demographic analysis of the participants and then classify them according to their privacy attitude. Afterwards, we make a comparison between their behaviours before and

---

<sup>3</sup> <https://www.adaptcentre.ie>

<sup>4</sup> <https://www.lero.ie/>

during the pandemic and also analyse the results for each class. In addition, we collect the participants' feedback/comments about the survey and analyse them using word cloud and sentiment classification. Such additional analysis improves the validity and reliability of our questionnaire. Note that sentiment analysis will be repeated in the main study by conducting sentiment analysis on the Irish public Twitter data.

### 3.1. Demographic Characteristics of the Respondents:

The age of the participants ranged from 18 to 74 years old, with a mean of 40.3 years. The largest age group is between 31 and 40 years old. The distribution of age groups is shown in Figure 1.

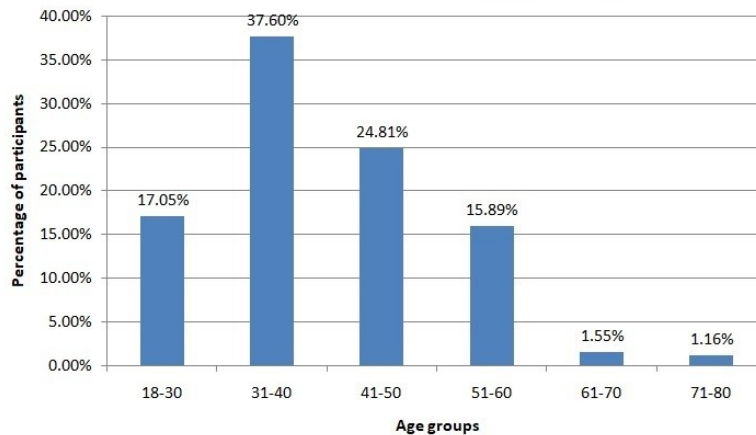


Figure 1: Participants' age distribution

Of all participants, 129 (50%) 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. This illustrates some of the challenges in reaching a representative sample of the population in Ireland using only social media channels.

### 3.2. General Privacy Profile of the Participants

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.

Westin classes are described as follows:

1. 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. An alternative terminology for "fundamentalist" is "pro-privacy".
2. 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. An alternative terminology for "pragmatist" is "ambivalent".
3. 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. An alternative terminology for “unconcerned” is “dismissive”.

### 3.2.1. Comparison with the baseline and other privacy studies

In Table 1 below we first summarize the results of the privacy studies conducted by Westin. Other privacy studies that rely on the PSI are included as well. As it can be seen from the table, similar to Westin studies, which is the baseline for our study, we have found out that most of the participants in the survey fall in the privacy pragmatist category. Our distribution in classes looks quite similar to Westin studies, and it is surprisingly closer to his initial studies rather than his later ones. Our distribution looks also similar to the one obtained by Motiwalla et al. (2016), but it differs quite a lot from the Malheiros et al. (2013). Their study had considerable more fundamentalists, however, privacy pragmatists were still the most representative group.

Study	#Fundamentalist	#Pragmatist	#Unconcerned
Westin studies (1995-1999)	~25%	~55%	~20%
Westin Mid (2000)	25%	63%	12%
Westin Late (2001)	34%	58%	8%
Westin (2003)	26%	64%	10%
Malheiros et al. (2013)	41%	48%	11%
Motiwalla et al. (2016)	27%	69%	6%
Our pilot study	27.5%	57%	15.5%

Table 1: Comparative study: baselines studies vs our pilot study

### 3.3. Privacy behaviour during COVID-19:

We use the following three questions (Table 2) from the questionnaire to estimate the participants' willingness to share their mobile data during COVID-19.

Questions	Possible answers
<b>Q1:</b> 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?	Strongly disagree Disagree Neutral Agree Strongly agree
<b>Q2:</b> Would you be concerned in relation to how your personal data would be used by the government and the relevant institutions in order to defeat COVID-19?	Not at all concerned Slightly concerned Somewhat concerned Moderately concerned Extremely concerned

<b>Q3:</b> Are you using the HSE COVID-19 Tracker <sup>5</sup> app?	Yes No
---	-----------

Table 2: Questions used to estimate the participants' willingness to share their mobile data

The following figures show the distribution of participants' answers grouped by prior privacy classification and also overall (for all participants).

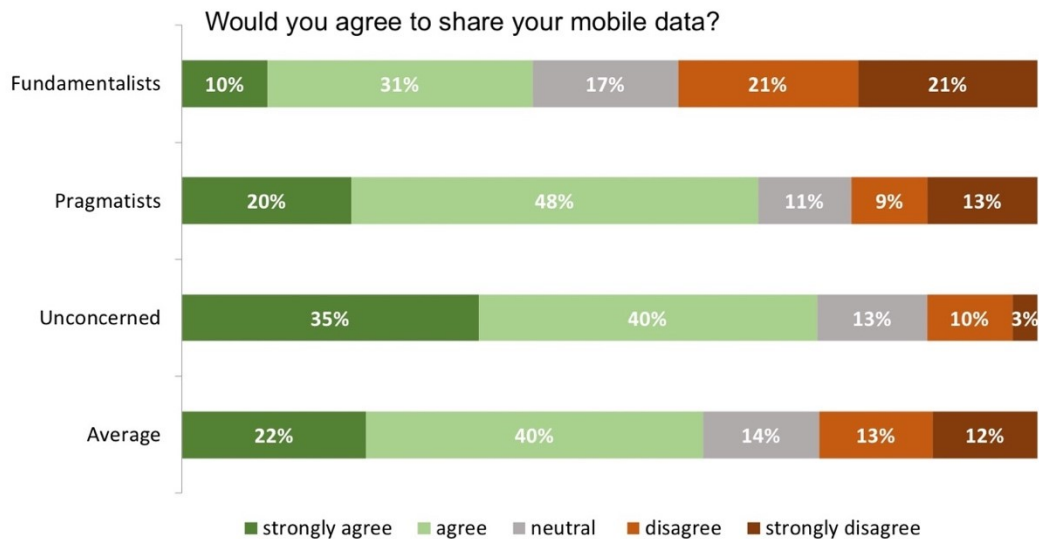


Figure 2: Result of Q1: willingness for sharing mobile data

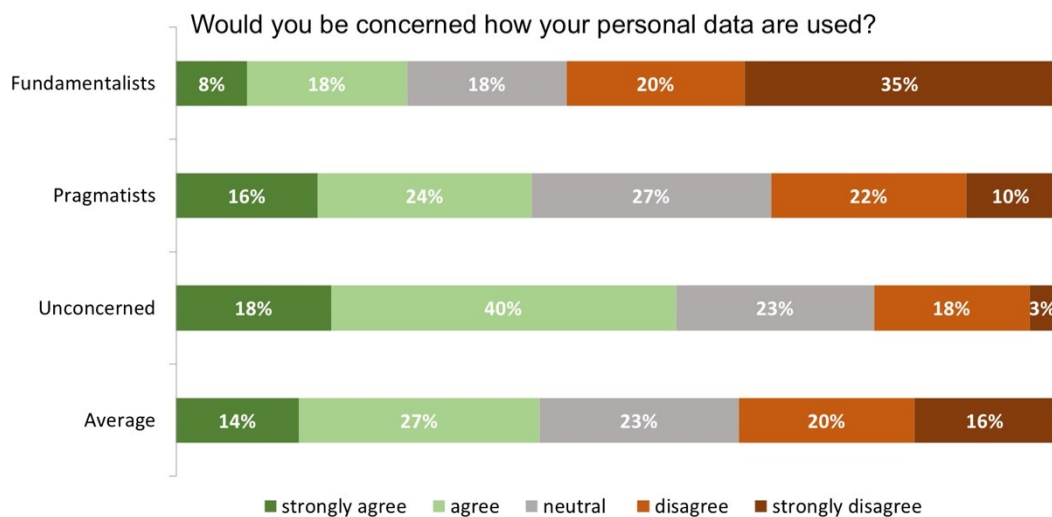


Figure 3: Result of Q2: Concerns about usage of personal data

In Figure 2, the green parts of the bars denote “agree” (strongly agree or agree) and the red parts denote “disagree” (disagree or strongly disagree). The grey part denotes the “neutral” responses. The colour scheme of Figure 3 is similar, i.e., starting from “not at all concerned” to “extremely concerned” (from left to right).

<sup>5</sup> COVID Tracker Ireland is a digital contact tracing app released by the Irish Government and the Health Service Executive on 7 July 2020 to prevent the spread of COVID-19 in Ireland.



We notice in Figure 2 that the percentage of people who agree to share mobile data is the lowest for fundamentalists. In contrast, 75% of unconcerned people agree with it, whereas the pragmatists fall between these two groups. This is expected because the fundamentalists are the most privacy sensitive and so they are mostly unwilling to share mobile data. As a comparison, the pragmatists are less sensitive and the unconcerned people are the least privacy sensitive and so they are mostly willing to share information. The overall percentage of ‘Strongly agree’ and ‘Agree’ in Q1 is 61%, which shows that the public has a positive attitude about sharing their mobile data to help defeat COVID-19.

In Figure 3, the percentages of answering ‘Not concerned’ ((Not at all and Slightly) in the three categories of people are 26%, 40% and 58%, respectively. The overall percentage of ‘Not concerned at all’ and ‘Concerned’ in Q2 together is 48%, if considering the ‘Neutral’, the percentage is 68%, which shows that when facing the COVID-19, most people become not too concerned about how your personal data would be used by the government.

Response	Fundamentalist	Pragmatist	Unconcerned	Overall
Yes	46%	58%	60%	55%
No	54%	42%	40%	45%

Table 3: Participants’ states of using the HSE COVID-19 Tracker app

Table 3 shows the responses to Q3 in Table 2. We notice that more than half of the participants in the pragmatist and unconcerned groups say “Yes”, i.e., they use the COVID-19 tracker app whereas slightly less than half of the fundamentalists use it. We notice similar observations here as well, i.e., the privacy concern decreases as we move from the fundamentalist group to the unconcerned group, therefore the percentage of people using the app increases. Overall, 63% of the respondents use the app, showing a positive signal.

There is an obvious increasing tendency from the group of fundamentalists to the group of unconcerned in all three questions. In general, we can say that the fundamentalists are more sensitive to privacy problems and the unconcerned people are least sensitive.

### 3.4. Risk score analysis:

The questions that are selected from the questionnaire to analyse the risk scores are listed in Table 4 below. Note that even with the same answer, the risk score ranks of the questions are different. For example, Q18 and Q19 use opposite score rank to keep the same meanings (the higher the score, the greater the feeling of concern or risk).

ID	Question	Answers	Score
Q18	I feel safe giving mobile apps access to my personal data and device tools.	Strongly disagree to Strongly agree	4-0
Q19	Providing mobile apps with access to personal data and device tools involves too many unexpected problems.	Strongly disagree to Strongly agree	0-4

Q20	I generally trust mobile apps with handling my personal data and device tools.	Strongly disagree to Strongly agree	4-0
Q21	How concerned are you about threats to your personal privacy when using mobile apps	Not concerned at all to Extremely concerned	0-4

Table 4: Questions used in risk analysis

We average the risk scores of the four questions for all participants and plot the results as a Histogram in the following figure.

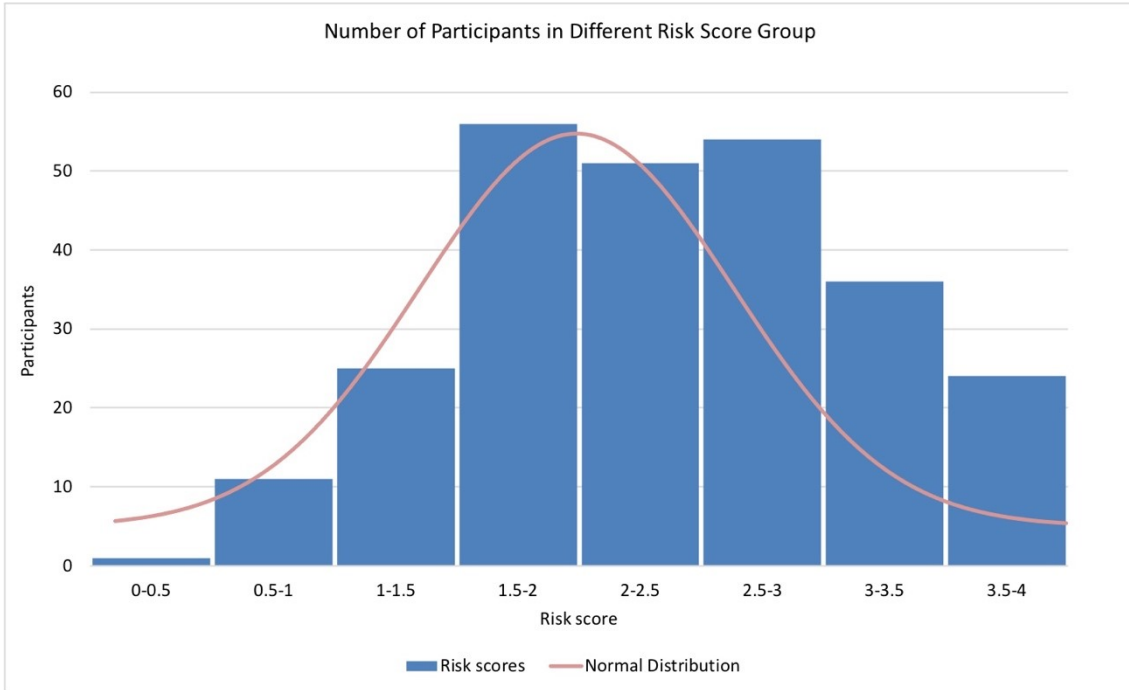


Figure 4: Histogram of risk scores

The above figure shows the number of participants in each risk score range. We used 10 different ranges from 0 to 4. We notice that most participants fall under the three ranges; (1.5,2.0), (2.1,2.5) and (2.5,3.0), i.e. between 1.5 and 3. This shows that most of the participants have an average concern about risk. The histogram depicted in Figure 4 shows an approximately normal distribution for the risk scores. Pearson's goodness of fit was used to confirm the normal distribution. The Pearson goodness of fit test,  $\chi^2 = 10.63$ . The critical value = 11.07 at a level of confidence of 95% and degree of freedom of 7. The test value is smaller than the critical value, therefore, the test fails to reject the null hypothesis which states that the data is normally distributed. The tails of the distribution contain people who have no regard for privacy and those who perceive a great deal of risk concerning their personal data. We found this 4-item scale for assessing whether the participants felt it risky to use mobile apps to be reasonably reliable, as measured through a Chronbach's  $\alpha$  of 0.81.

The risk score analysis is also conducted within three participant groups and the result is plotted in Figure 5.

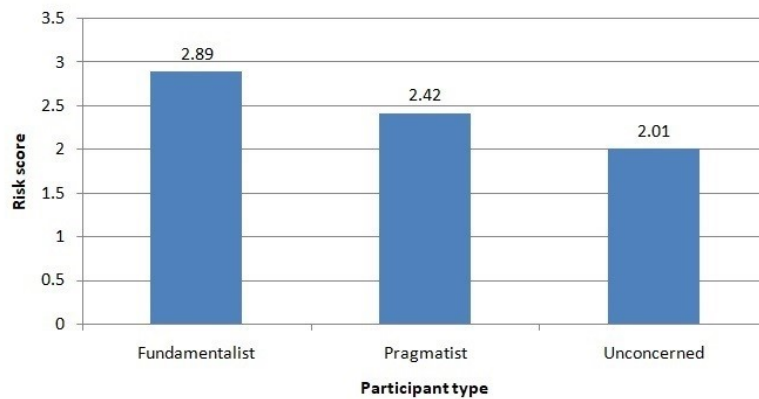


Figure 5: Average risk score for each participant type

Based on 2-sample t-tests, the results show that privacy fundamentalists had statistically significantly greater risk scores than both privacy pragmatists ( $t(216)=4.29$ ,  $p<.0x001$ ) and privacy unconcerned ( $t(109)=5.95$ ,  $p<.0001$ ).

This is expected because the participants belonging to the fundamentalist group are the most privacy sensitive and therefore produce high risk scores. In contrast, the unconcerned people are the least privacy sensitive and so they produce the lowest average risk score, whereas the pragmatist group falls between these groups producing average risk scores. For this reason, we notice a decline in risk scores as we move left to right from the fundamentalist to the unconcerned group.

### ***3.5. Attitude change during COVID-19 times:***

Part 3 of the questionnaire is about the investigation of participants' attitudes toward privacy during COVID-19 situation. This part of the questionnaire includes two questions; Q24 and Q27. These two questions are the opposite of each other which can show the change of attitude of participants before and during the COVID-19 situation. Q24 asks the participants if they agree to share their mobile data with the government and relevant institutions to help defeat COVID-19 whereas Q27 asks if they are willing to do so during normal circumstances.

We analyse the participants' responses to the above questions in combination with PSI. We count the answers (from Strongly agree to Strongly disagree) of each group and also for all participants. The results are plotted in Figure 6.

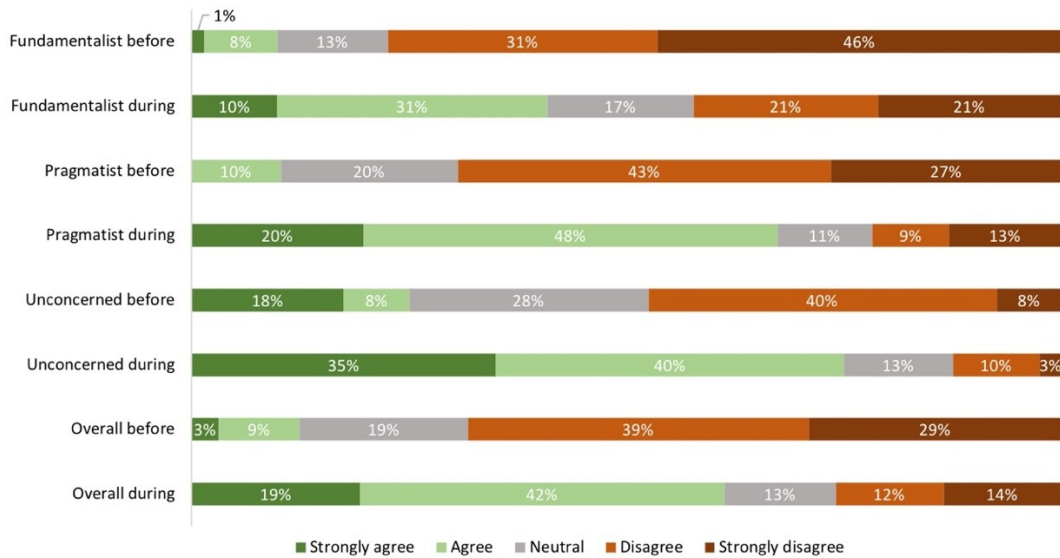


Figure 6: Change in privacy attitudes before and during COVID-19 times

We can observe that the count of “Strongly agree” and “Agree” has increased when answering Q24 as compared to the answers of Q27. This clearly shows that the participants are more willing to share their mobile data during COVID-19 pandemic. Furthermore, for conciseness, we classify “Strongly agree” and “Agree” as “agree”, “Disagree” and “Strongly disagree” as “disagree” and plot the result in Figure 7.

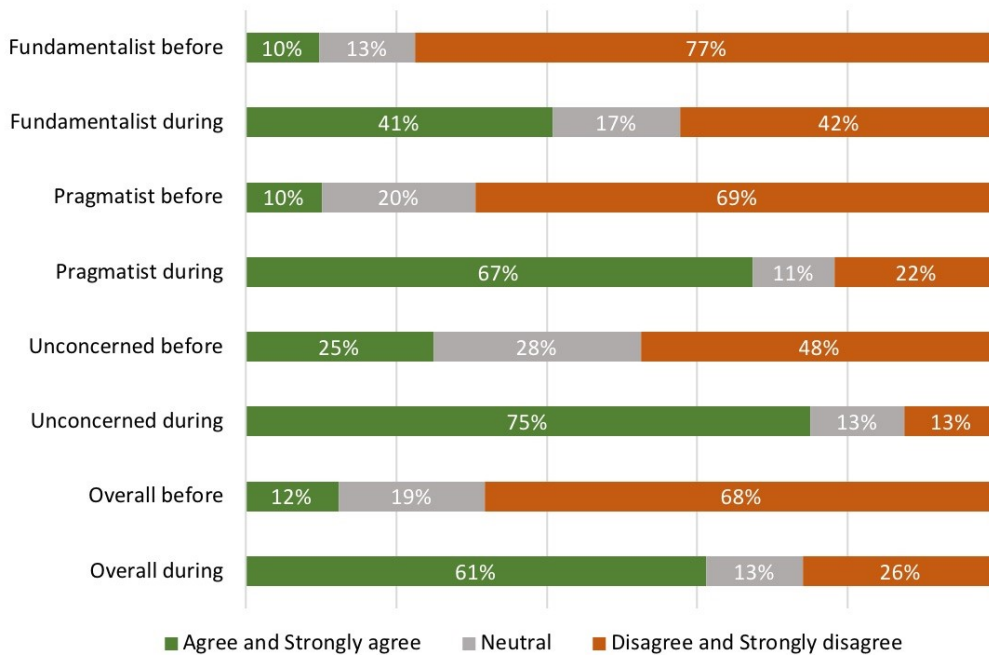


Figure 7: Capturing the change in privacy attitudes before and during COVID-19 times

Figure 7 above clearly shows the change in attitude. 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).

The participants in the survey were also asked to select the type of data they are more inclined to share, and their responses were summarized in Table 5.

Type of Data	Percentage of the participants willing to share it
Health status data	27%
Anonymized mobile geo-location data	26%
Personal details (e.g. name, gender, age, etc.)	18%
Exact mobile geo-location data	16%
Contact list	10%

Table 5: Type of data that participants are willing to share

Figure 8 shows the distribution of the type of data that each privacy group is willing to share. For example, 67% of privacy fundamentalists are willing to share “anonymized mobile Geo-location data” and not surprisingly they are not really willing to share exact Geo-location. Moreover, out of the 3 groups, they are the least inclined to share any other type of data (e.g. personal details, health status data). The unconcerned group is the one willing to share the most diverse type of data with 60% willing to also share personal details. The pragmatists are more willing to share health status data than any other types of data and this may be attributed to the pandemic context and their attitudes toward privacy that translates into weighing the pros and cons. All groups seem to be mindful of other people's privacy and show the least willingness in disclosing the contact list.

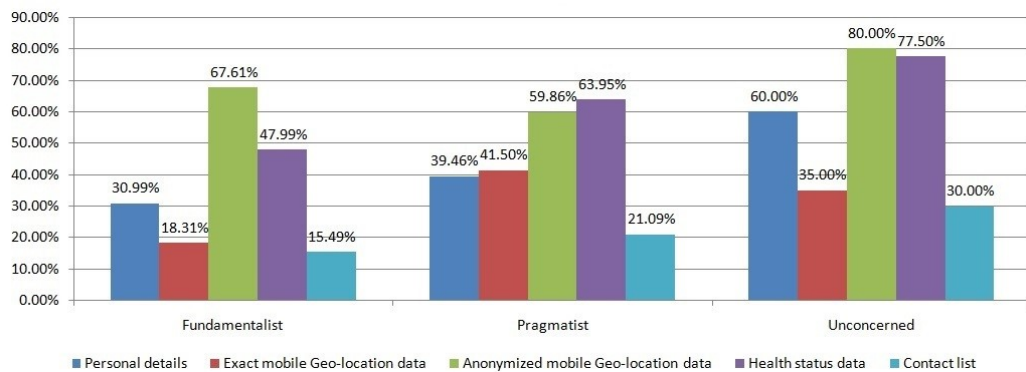


Figure 8: Preference of the type of data per privacy group

In addition, the participants in the pilot study trust health authorities the most with their data over the Government or any other organizations as can be seen in Table 6.

Who are you willing to share your data with?	Percentage of the participants
Health authorities	48%
Government	30%
Public apps sharing anonymized data	20%
Public apps sharing individual data	1%

Table 6 : Who are the participants willing to share their data with?

It is found that out of 258 respondents, 142 (55%) are using the COVID-19 tracker app. However, according to the article<sup>6</sup> published by “thejournal.ie” in October 2020, over 2.1 million registrations have been made to Ireland’s COVID-19 tracker app. This is approximately 45% of the total 4.75 million population of Ireland.

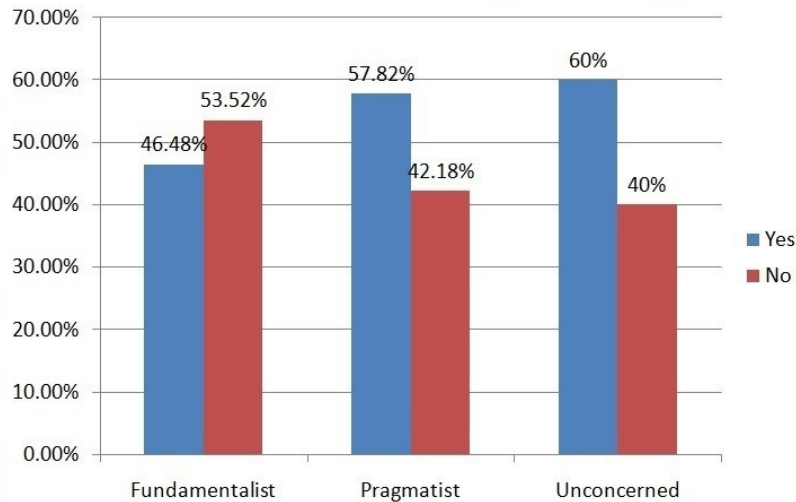


Figure 9: Usage of COVID-19 tracker app for each participant type

Figure 9 shows the usage of COVID-19 tracker for each participant type in this pilot study. We observe from this figure that as we move from the “fundamentalist” towards the “unconcerned” participants, the percentage of using the app increases. This is expected because the fundamentalists are highly concerned about their privacy, therefore are less interested in using the tracker app that accesses their personal information. In contrast, the pragmatists are less concerned about their privacy, therefore, they are using the tracker app significantly more than the fundamentalists (11% more). Finally, the unconcerned participants are least concerned about their privacy, therefore, they are using it more than any other groups.

### ***3.6. Analysis of the COVID-19 tracker app unsatisfactory user experience:***

One of the questions in the questionnaire asks the participants to explain the reasons if they are unsatisfied with the COVID-19 tracker app. We found 16 participants who have such issues.

The analysis of their comments in the form of a word cloud is shown in Figure 10 below.

---

<sup>6</sup> <https://www.thejournal.ie/covid-tracker-app-5237727-Oct2020/>



The above figure contains both negative and positive terms used in the feedback/comments. Some of the examples of positive terms are “Good”, “happy”, “Interesting” etc which reflect that some of the participants are happy with the survey or the COVID-19 tracker app and they consider it good and interesting. In contrast, some other terms such as “breaches”, “fixing”, “confidential”. etc. reflect negative outcomes of the app. This word cloud shows that people have mixed feelings (both positive and negative) about the survey or COVID-19 tracker app.

We performed a manual sentiment analysis on this feedback/comments and classified them into the following three classes in terms of the degree of sentiment.

- I. Negative: the participants express negative feelings, opinions
- II. Positive: the participants express their positive feelings
- III. Neutral: the comments are neither negative nor positive

We show the distribution of the sentiment classes in figure 12 below.

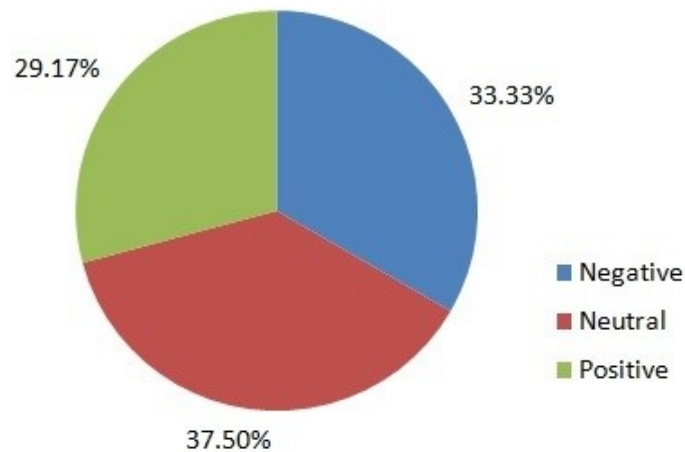


Figure 12: Distribution of sentiment classes of feedback/comments

We observe from the above figure that exactly one third (33.33%) of the feedback/comments are negative whereas 37.5% and 29.17% are neutral and positive, respectively. However, we notice that the majority, i.e. 62.5% of the feedback/comments convey a specific sentiment, either negative or positive. Note that most of the neutral comments found are either the information provided by the participants or a question asked by them without having any sentiment in it. The rest of the comments are irrelevant to this study.

#### 4. Discussion

This pilot represents an intermediary step in a study on people’s attitudes towards privacy in times of COVID-19 at a national level that will be carried out in the Republic of Ireland. We designed a survey questionnaire in order to analyse the participants’ responses to two different scenarios: (i) normal circumstances and (ii) during COVID-19 pandemic. The analysis of the results demonstrated that the survey created is able to capture the general privacy attitudes and the changes in privacy attitudes during COVID-19 times. General privacy concerns of the participants follow a similar distribution to previous privacy studies based on Westin’s PSI. Risk behaviours are also aligned with privacy concerns. The results of the pilot showed a change in attitude during the pandemic with a dramatic



increase in the percentage of people willing to share their personal data in the interest of saving lives during the pandemic: from 12% to 61%.

Furthermore, we analysed the participants' behaviour towards the COVID-19 tracker app. We found that 55% of the respondents are using this app. As expected, privacy attitudes have an impact on the adoption of the app. The fundamentalists are the least users of this app as they are highly concerned about the risk related to their personal information being exposed by such mobile apps, while the unconcerned have the highest adoption rate of the app.

The results obtained cannot be considered at this point as representative for the general Irish public as the pilot had a limited release using certain distribution channels only. The national survey that is based on the questionnaire developed following this pilot study will aim to target a larger and diverse audience.

Finally, we analyse the feedback/comments written by the people who participated in this survey. Sentiment analysis was performed in this regard. Some of the participants wrote positive comments and they felt that this is an interesting study while the others show their dissatisfaction with the app and express their concern about security breaches. Minor suggestions in terms of improving the clarity of some questions were provided and these were taken into account in the final version of the questionnaire.

Moreover, following the pilot study, a workshop with the project stakeholders was organised. They were presented with an initial set of the pilot results and analysis and made specific recommendations for improving the questionnaire and the dissemination of the national survey. Among the stakeholders involved were: HSE (Health Service Executive)<sup>7</sup>, FPF (Future of Privacy Forum)<sup>8</sup>, Microsoft Ireland, CSO (Central Statistics Office)<sup>9</sup>, OSI (Ordnance Survey Ireland)<sup>10</sup>, Irish Council for Civil Liberties<sup>11</sup>, Ericsson Ireland. The updates to the questionnaire were mostly done to improve the clarity of the questions, to make them understandable and accessible to people from various socio-economic and educational backgrounds. Examples of these updates are: some questions had some minor typos corrected, some questions were updated to improve the clarity of the questions by for instance providing examples or cross-referencing other questions where a concept will be explained. In addition, the demographic part of the questionnaire was updated to include the occupation, including Higher Diploma as an option in the education-related question and modifying the age-related question to have ranges instead of being an open question. In part 3 of the questionnaire, we added the following questions: *“Have you, a member of your family or a close friend contacted the virus? (yes/no/I prefer not to answer)”* and *“Would you be concerned about your mobile data being transferred to other countries within the EU in order to defeat COVID-19? (Not at all concerned, Slightly concerned, Somewhat concerned, Moderately concerned, Extremely concerned)”*. Furthermore, a couple of questions from Part 2 of the questionnaire were removed as they were deemed as not relevant for the Irish landscape. Finally, we have added more positive options in one of the questions in relation to the HSE COVID Tracker app. In addition, The final version was also reviewed by Dr Aphra Kerr, Associate Professor of Sociology, co-convenor of the Maynooth University's Technology and Society interdisciplinary research network and leading member of the ADAPT Ethics and Privacy Working Group.

---

<sup>7</sup> HSE official website: [www.hse.ie](http://www.hse.ie)

<sup>8</sup> Future of Privacy Forum, official website: <https://fpf.org/>

<sup>9</sup> Central Statistics Office, official website: <https://www.cso.ie/>

<sup>10</sup> Ordnance Survey Ireland, official website: <https://www.osi.ie/>

<sup>11</sup> Irish Council for Civil Liberties, official website: <https://www.iccl.ie/>

## 5. Concluding remarks and future directions

The main objective of this research was to design a study that is able to capture attitudes toward privacy, changes in attitudes toward privacy in COVID-19 times and the impact of these attitudes on the adoption of technological solutions designed to help with the management of this health crisis. The study was designed around an online privacy questionnaire that we have built and tested in a pilot study. This paper presented and discussed an initial set of results of the study that were collected from 258 participants from the Republic of Ireland mostly recruited through social media channels. While interesting insights into the privacy attitudes in COVID-19 times and before were obtained, these results are not representative of the general Irish public. The analysis of the results was mainly used to validate the ability of the designed questionnaire to capture attitudes towards privacy in normal circumstances and in COVID-19 times and their impact on the adoption of technologies aimed at helping with the crisis (e.g. tracker apps). The refined questionnaire following this pilot study will be used in the national survey on privacy in COVID-19 times. We will also complement our research study by conducting sentiment analysis on the Irish public Twitter data, which we hope can enable larger-scale studies and lead to more and better insights.

### Acknowledgements

This work was supported by Science Foundation Ireland through COVID Rapid Response programme grant number 20/COV/0229 and through the grant 13/RC/2094 co-funded under the European Regional Development Fund through the Southern and Eastern Regional Operational Programme to Lero - the Irish Software Research Centre ([www.lero.ie](http://www.lero.ie)) and the ADAPT Centre for Digital Content Technology ([www.adaptcentre.ie](http://www.adaptcentre.ie)) [grant number 13/RC/2106].

### References

Allam, Zaheer and Dey, Gourav and Jones, David S, 2020. Artificial intelligence (AI) provided early detection of the coronavirus (COVID-19) in China and will influence future Urban health policy internationally. *AI*, Volume 1, pp. 156--165.

Altmann, Samuel and Milsom, Luke and Zillessen, Hannah and Blasone, Raffaele and Gerdon, Frederic and Bach, Ruben and Kreuter, Frauke and Nosenzo, Daniele and Toussaert, Severine and Abeler, Johannes, 2020. Acceptability of app-based contact tracing for COVID-19: Cross-country survey evidence. *Available at SSRN 3590505*.

Andrew Crocker, Kurt Opsahl and Bennett Cyphers, 2020. *The challenge of proximity apps for COVID19 contact tracing*. [Online] Available at: <https://www.eff.org/deeplinks/2020/04/challenge-proximity-apps-covid-19-contact-tracing> [Accessed April 2020].

Cho, Hyunghoon and Ippolito, Daphne and Yu, Yun William, 2020. *Contact tracing mobile apps for COVID-19: Privacy considerations and related trade-offs*, s.l.: arXiv preprint arXiv:2003.11511.

COVID-19, 2020. How Korea is using innovative technology and AI to flatten the curve. [Online] Available at:

<https://www.itu.int/en/myitu/News/2020/05/06/11/53/COVID19-How-Korea-is-using-innovative-technology-and-AI-to-flatten-the-curve>. [Accessed September 2020].

Jay Stanley and Jennifer Stisa Granick, *The Limits of Location Tracking in an Epidemic*. [Online] Available at: <https://www.aclu.org/report/aclu-white-paper-limits-location-tracking-epidemic> [Accessed 8 April 2020].

Hughes, Jennifer L and Camden, Abigail A and Yangchen, Tenzin, 2016. Rethinking and updating demographic questions: Guidance to improve descriptions of research samples. *Psi Chi Journal of Psychological Research*, Volume 21, pp. 138-151.

Jansen-Kosterink, Stephanie Maria and Hurmuz, Marian and den Ouden, Marjolein and van Velsen, Lex , 2020. Predictors to use mobile apps for monitoring COVID-19 symptoms and contact tracing: A survey among Dutch citizens. medRxiv.

Kumaraguru, Ponnurangam and Cranor, Lorrie Faith, 2005. Privacy Indexes: A Survey of Westin's Studies (Report No. CMU-ISRI-5-138), *Institute for Software Research International, School of Computer Science, Carnegie Mellon University, Pittsburgh, PA*.

Vernon J Lee, Calvin J Chiew, and Wei Xin Khong, 2020. Interrupting transmission of COVID-19: lessons from containment efforts in Singapore. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7107552/pdf/main.pdf>.

O'Callaghan, Michael Edmund and Buckley, Jim and Fitzgerald, Brian and Johnson, Kevin and Laffey, John and McNicholas, Bairbre and Nuseibeh, Bashar and O'Keeffe, Derek and O'Keeffe, Ian and Razzaq, Abdul and others , 2020. A national survey of attitudes to COVID-19 digital contact tracing in the Republic of Ireland. *Irish Journal of Medical Science (1971-)*, pp. 1--25.

Ashkan Soltani, Ryan Calo, and Carl Bergstrom, 2020. *Contact tracing apps are not a solution to the COVID-19 crisis*. [Online] Available at: <https://www.brookings.edu/techstream/inaccurate-and-insecure-why-contact-tracing-apps-could-be-a-disaster/>

Wiertz, Caroline and Banerjee, Aneesh and Acar, Oguz A and Ghosh, Adi, 2020. Predicted Adoption Rates of Contact Tracing App Configurations-Insights from a choice-based conjoint study with a representative sample of the UK population. Available at SSRN 3589199.

Tsai, J., Cranor, L.F., Acquisti, A. and Fong, C.M., 2006. What's it to you? a survey of online privacy concerns and risks. A Survey of Online Privacy Concerns and Risks (October 2006) .NET Institute Working Paper, (06-29).

Malheiros, M., Preibusch, S. and Sasse, M.A., 2013, June. "Fairly truthful": The impact of perceived effort, fairness, relevance, and sensitivity on personal data disclosure. In *International Conference on Trust and Trustworthy Computing* (pp. 250-266). Springer, Berlin, Heidelberg.

Motiwalla, L.F. and Li, X.B., 2016. Unveiling consumers' privacy paradox behaviour in an economic exchange. *International journal of business information systems*, 23(3), pp.307-329.

Elueze, I. and Quan-Haase, A., 2018. Privacy attitudes and concerns in the digital lives of older adults: Westin's privacy attitude typology revisited. *American Behavioral Scientist*, 62(10), pp.1372-1391.

Kuzmanovic, M. and Savic, G., 2020. Avoiding the Privacy Paradox Using Preference-Based Segmentation: A Conjoint Analysis Approach. *Electronics*, 9(9), p.1382.

Holvast, J., 2007. History of privacy. In *The History of Information Security* (pp. 737-769). Elsevier Science BV.

Chignell, M.H., Quan-Haase, A. and Gwizdka, J., 2003, October. The privacy attitudes questionnaire (paq): initial development and validation. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 47, No. 11, pp. 1326-1330). Sage CA: Los Angeles, CA: SAGE Publications.

CELESTE, E., The Court of Justice and the Ban on Bulk Data Retention: Expansive Potential and Future Scenarios. *European Constitutional Law Review*, v. 15, 2019.