Northern Ireland Assembly

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# The Use Of Digital Measures To Combat COVID-19

**Sinéad McMurray**

This paper has been produced to support the COVID-19 Ad Hoc Committee and the Health Committee with their scrutiny of the pandemic response. The purpose of this paper is to provide information for the health committee on the use of digital measures aimed at combating the novel coronavirus COVID-19, specifically contact tracing apps and the use of 'big data'. The paper will examine the current and potential uses of both types of measures at various stages of the pandemic as well as the technical and ethical challenges that they present. The focus of this paper will be on the use of these measures in a European and UK context with reference to international experiences where appropriate.

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# 1 Introduction

Governments and health authorities are increasingly relying on data-driven technologies to help contain the novel coronavirus, Covid-19. Technological solutions for contact tracing, quarantine enforcement and monitoring the spread of the virus are being produced at a rapid pace as countries attempt to emerge from lockdown. In Asian countries such as China, Singapore and Taiwan the swift and early introduction of technological responses to the pandemic were seen as crucial to their success in containing the virus at an early stage. China's use of digital technologies in particular are without parallel in this pandemic ranging from the accessing and monitoring of citizens' use of social media and communication apps, to the use of drone technology to enforce population quarantine and the application of facial recognition technology to identify suspected infected individuals.[1]

Undoubtedly, the extensive use of digital technologies in Asian countries' response to the pandemic are in part made possible due to existing state surveillance cultures and varying levels of democracy. In Europe legal restrictions and a strong privacy culture make the adoption of Asia's more intrusive digital applications potentially unlikely. [2] However, European countries have been quick to explore how these digital solutions could be adapted in a European context. As a result some digital applications specifically, the use of contact tracing apps and the analysis of big data, have been embraced and have become standard in the efforts of European countries to contain the pandemic.[3]

In response to the proliferation of contact tracing apps and the extensive use of big data analytics across Europe, the EU Commission has called for a cohesive Pan-European approach to both types of digital solutions.[4] The Commission is keen to ensure interoperability of the various contract tracing apps that are being developed, as well as harnessing the full potential of big data while at the same time ensuring that any use of personal data adheres to existing data protection and privacy legislation.

Despite these calls for unity an increasingly fragmented landscape has emerged in Europe, particularly in relation to contact tracing apps.[5] Tensions have also arisen between governments and Civil Liberty groups with the latter increasingly concerned about whether the rights of citizens are being given due consideration as governments adopt these digital measures at a rapid pace.[6]

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[1] Roberts, SL (2020) Tracking Covid-19 using big data and big tech: a digital Pandora's Box, London School of Economics, 20th April 2020 https://blogs.lse.ac.uk/politicsandpolicy/tracking-covid-19/

[2] Yixiang Xu (2020) Fighting the COVID-19 Pandemic with Big Data: Why Germany Should Learn from China's Digital Experiments, American Institute for Contemporary Germanic Studies, March 12th 2020 https://www.aicgs.org/2020/03/fighting-the-covid-19-pandemic-with-big-data-why-germany-should-learn-from-chinas-digital-experiments/

[3] https://www.aicgs.org/2020/03/fighting-the-covid-19-pandemic-with-big-data-why-germany-should-learn-from-chinas-digital-experiments/

[4] Coronavirus: Guidance to ensure full data protection standards of apps fighting the pandemic, European Commission Website, https://ec.europa.eu/commission/presscorner/detail/en/ip_20_669

[5] https://www.politico.eu/article/coronavirus-tests-europe-resolve-on-privacy-tracking-apps-germany-italy/

[6] https://www.hrw.org/news/2020/05/13/mobile-location-data-and-covid-19-qa

This paper focuses on the development of contact tracing apps as well as the use of big data analytics in Europe, the UK and a number of selected countries. The paper will explore the benefits and draw backs of both types of digital solutions as well as their implication for data protection legislation and the privacy right of citizens.

# 2 Contact tracing apps and COVID-19

The World Health Organisation (WHO) describes contact tracing as an effective public health measure for the control of COVID-19 which in conjunction with robust testing and surveillance systems, is seen as crucial to successfully easing lockdown measures.[7] The European Centre for Disease Prevention and Control (ECDPC) has stated that new technologies such as contact management software and mobile apps are crucial to tracking and testing strategies when dealing with an infectious disease on the scale of COVID-19. [8]

Oxford University's Big Data Institute have worked with government officials in several European countries to explain the benefits of a mobile app that could provide valuable data for any coronavirus tracking and tracing strategy. Speed and effectiveness to alert people that may have been exposed are paramount during a pandemic such as coronavirus. The institute are keen to stress that a mobile app can speed up the notification process to slow the rate of spread while maintaining ethics. [9]

## 2.1 How contact tracing apps work

A contact tracing app's primary purpose is to quickly notify people who have been in close proximity to a confirmed case of COVID-19 that they may be infected so that they can take precautions before they infect others, thus breaking the onward chain of transmission. The advantage of the app is that it can identify people the patient may not know - like fellow passengers on a bus (providing they also have the app) – so they can be notified faster than would be possible with manual contact tracing. [10]

The majority of contact tracing apps being developed in Europe use bluetooth signals to track a user's movements and who they have been in contact with. Bluetooth, by design, is constantly reaching out and touching other Bluetooth-enabled devices, for example, it is how a phone detects a smart home device or wireless earphones connect to music on a smartphone. In

[7] Contact tracing in the context of COVID-19 Interim guidance, World Health Organisation, 10 May 2020, https://www.who.int/publications-detail/contact-tracing-in-the-context-of-covid-19
[8] Contact tracing for COVID-19: current evidence, options for scale-up and an assessment of resources needed, Technical Report, 5 May 2020, European Centre for Disease Prevention and Control Website, https://www.ecdc.europa.eu/en/publications-data/contact-tracing-covid-19-evidence-scale-up-assessment-resources
[9] Infectious disease experts provide evidence for a coronavirus mobile app for instant contact tracing https://www.bdi.ox.ac.uk/news/infectious-disease-experts-provide-evidence-for-a-coronavirus-mobile-app-for-instant-contact-tracing
[10] Lawrie, E (2020) Coronavirus: How does contact tracing work and is my data safe? BBC News, 20th May, 2020 https://www.bbc.co.uk/news/explainers-52442754

normal circumstances a phone's bluetooth signals make brief contact with other phones and devices that pass nearby (within 30 feet), and if they aren't recognized, they delete each other from their respective memories as soon as possible.[11]

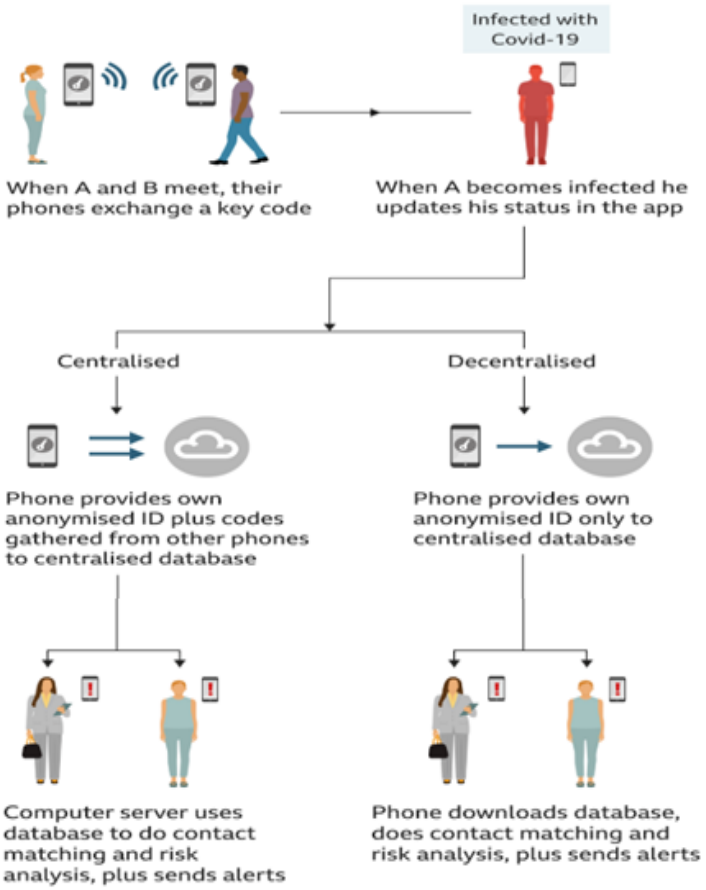
The type of contact tracing being tested and deployed around the world now uses Bluetooth signals very similar to the ones a phone already transmits and receives constantly. The difference is it does not automatically forget the other devices it comes into contact with. When a person is diagnosed with COVID-19, the app will notify all other phones the infected person's bluetooth signals have recently been close enough to connect to. This is all done anonymously. [12] Those devices would be alerted within seconds that they had recently been in contact with someone who has now been diagnosed with COVID-19. The notification they receive might also contain information on what the affected person can do next: Download an app or call a number for testing.[13]

## 2.2 'Centralised' versus 'decentralised' approaches

The conflict concerning the development of contact tracing apps in Europe and their infringement or otherwise on privacy is centred on whether the app uses a 'centralised' or 'decentralised' architecture. In the centralised architecture, the process of passing anonymised information from the sick individual to their contacts is done through a central server controlled by a health authority. When an individual self-reports symptoms or is diagnosed as a confirmed case, their contact history is uploaded to the server which performs risk assessment computations and sends notifications to some of their contacts accordingly.[14]

In the decentralised architecture, the process of passing information from the sick individual to their contacts happens through direct broadcasts of anonymised lists of sick individuals over the phone network. Each phone then regularly performs a computation to determine whether it has been associated with a risky contact or with one of the sick individuals. The decentralised approach is widely thought to be better from a privacy perspective but the centralised approach is thought to offer better accuracy and better information for the health authority to plan resources.[15] The infographic below from the BBC demonstrates how both types of architecture work.

[11] Coldewey, D (2020) What is contact tracing? Tech Crunch, 18th April 2020, https://techcrunch.com/2020/04/18/what-is-contract-tracing/
[12] Coldewey, D (2020) What is contact tracing? Tech Crunch, 18th April 2020, https://techcrunch.com/2020/04/18/what-is-contract-tracing/
[13] Coldewey, D (2020) What is contact tracing? Tech Crunch, 18th April 2020, https://techcrunch.com/2020/04/18/what-is-contract-tracing/
[14] Bonsall, D and Kendall, M (2020) balancing functionality with privacy for effective contact tracing apps, University of Oxford-Big Data Institute, 8th May 2020 https://045.medsci.ox.ac.uk/app-approaches
[15] Bonsall, D and Kendall, M (2020) balancing functionality with privacy for effective contact tracing apps, University of Oxford-Big Data Institute, 8th May 2020 https://045.medsci.ox.ac.uk/app-approaches




The debate over which approach is best has created an increasingly fragmented landscape in Europe with regard to the development of contact tracing apps which will be discussed later in the paper.

## 2.3 Tensions have emerged between app infrastructures in Europe

When the use of contact tracing apps were first proposed in Europe, there were calls for a single European approach with regard to their development to ensure compatibility between the various platforms being developed and a common set of privacy standards.[16] In an attempt to achieve this it was announced that a coalition of 130 scientists from eight countries would create an app using a set of "standards, technology and services" called pan-European Privacy-Preserving Proximity Tracing (PEPP-PT). The app being proposed would not collect location data, would comply with Europe's strict privacy laws and would be interoperable across borders.[17]

Most countries in Europe were in agreement that short-range Bluetooth "handshakes" between mobile devices were the best way of registering potential contacts of someone who has been

[16] Meyer, D (2020) Europe's plan to save the sacred summer vacation depends on contact-tracing apps—but there's a problem. Fortune Magazine May 13th 2020 https://fortune.com/2020/05/13/european-tourism-coronavirus-contact-tracing/
[17] Espinoza, J et al (2020) How Europe splintered over contact tracing apps. Financial Times. May 10th 2020. https://www.ft.com/content/7416269b-0477-4a29-815d-7e4ee8100c10

infected by COVID-19. However, quite early in the development process a split emerged between developers centring on whether apps should be run using a centralised or decentralised model. [18] The PEPP-PT proposed a centralised model.[19] Concerns about the impact that centralised architecture could have on privacy, a group of scientists from the original PEPP-PT project formed a separate project called Decentralised Privacy-Preserving Proximity Tracing (DP-3T) which proposed a decentralised model for contact tracing apps.

## 2.4 Apple/Google collaboration disrupts centralised approach

In mid-April, Apple and Google announced joint support for decentralized contact tracing apps and the work of DP-3T by confirming it was working to develop a technology platform to support decentralised contact tracing apps with the ultimate aim of integrating the technology into their operating systems. The collaboration enables phones from both companies to work together, but also sets strict limits on what data can be sent back to public health authorities with the tech companies confirming that their platform would not support the type of centralised apps being proposed by PEPP-TP.[20] Contact tracing apps that do not conform to the privacy requirements of the Google/Apple technology can still be built, but they face strict limits, particularly on Apple phones. For example, they won't work when "backgrounded", as when another app or game is in use on the phone, nor when the screen is locked entirely.[21]

As well as preventing excess data from being sent back to public health authorities, the technology will have other constraints. Apple and Google say they will maintain the ability to disable their contact tracing tools on a regional basis once the current crisis is over, and they will refuse to authorise any government which seeks to make installing the apps compulsory. The companies have also said they will only allow one app per country, or state in the US, to use the platform.[22]

## 2.5 Existing centralised apps further highlight potential issues

Norway, one of the first European countries to begin lifting restrictions, already has a centralised app in operation. The "Smittestop" or "stop infection" app uses both Bluetooth and GPS location data to track user's movements, which differs from the majority of other Europe countries who have chosen to use solely Bluetooth data. The developer claims that the combination of the two signals leads to very accurate contact tracing results without the need for the Google-Apple interface.[23] The government has stated that the app fully complies with EU data protection regulations and user's data is automatically deleted after 30 days.

[18] Lomas, N (2020) EU privacy experts push a decentralized approach to COVID-19 contacts tracing. Tech Crunch. April 6th 2020 https://techcrunch.com/2020/04/06/eu-privacy-experts-push-a-decentralized-approach-to-covid-19-contacts-tracing/
[19] Criddle, C &Kelion, L (2020) Coronavirus contact-tracing: World split between two types of app. BBC News. 7th May 2020 https://www.bbc.co.uk/news/technology-52355028
[20] Busvine, D and Rinke, A (2020) Germany flips to Apple-Google approach on smartphone contact tracing. https://www.reuters.com/article/us-health-coronavirus-europe-tech/germany-flips-on-smartphone-contact-tracing-backs-apple-and-google-idUSKCN22807J
[21] Hern, A (2020) France urges Apple and Google to ease privacy rules on contact tracing, The Guardian, 21st April 2020, https://www.theguardian.com/world/2020/apr/21/france-apple-google-privacy-contact-tracing-coronavirus
[22] McMcarthy, K (2020) UK finds itself almost alone with centralized virus contact-tracing app that probably won't work well, asks for your location, may be illegal, Tuesday 5th May 2020 https://www.theregister.co.uk/2020/05/05/uk_coronavirus_app/
[23] Smitstopp Q and A, Simula, 9th April 2020 https://www.simula.no/news/digital-contact-tracing-qa

However, this has raised privacy concerns among Norwegian citizens and the app has demonstrated a relatively high dropout rate. The Norwegian Institute of Public Health said that as of 28 April, 1.5 million people had downloaded the app, but only 899,142 were actively using it - representing just 20.5% of over-16s in the test zones.[24] Commentators have also highlighted that as Apple's market share in Norway is over 50% and their platform does not support centralised apps, they expect substantial gaps in coverage.[25]

Australia also released a contact-tracing app. It too had indicated it had found a way to work without the need for the Google-Apple interface, but has since acknowledged power consumption problems as well as "interference" if users have other Bluetooth and location-tracking apps open.[26] Finally, Singapore's centralised TraceTogether app was widely viewed as the one to emulate. However it has since emerged the app is only being used by about 20% of the local population, with distrust of government surveillance emerging as a key factor in the limited takeup.[27]

## 2.6 A move towards decentralised models

Initially key EU states including Germany, France, Italy and the UK were supportive of a more centralised approach whereas countries like Switzerland, Belgium and Austria preferred the decentralised approach being proposed by DP-3T. However, the announcement by Google and Apple of their standalone technology prompted Italy and Germany to switch to a decentralised model and a host of other European countries followed.[28] Currently France and the UK are still pursuing the centralised model and Spain remains undecided.

The European Data Protection Board (EDPB) and the European Data Protection Supervisor (EDPS) have both expressed preference for the de-centralised model, since it minimises the potential for privacy infringements and the system is less open to potential hacking. However, both authorities have also said that either approach can be consistent with the necessary data protection requirements as long as they are deployed and maintained properly.[29]

[24] Kelion, L and Criddle, C (2020) Coronavirus contact-tracing: World split between two types of apps https://www.bbc.co.uk/news/technology-52355028

[25] Skille, OB (2020) Norwegian contact tracing app blames Apple design for centralised GPS location database 9th April 2020 https://privacyinternational.org/examples/3663/norwegian-contact-tracing-app-blames-apple-design-centralised-gps-location-database

[26] Lomas, N (2020) Germany ditches centralised approach to app for COVID-19 contact tracing app, Tech Crunch, 27th April 2020, https://techcrunch.com/2020/04/27/germany-ditches-centralized-approach-to-app-for-covid-19-contacts-tracing/

[27] Criddle, C & Kelion, L (2020) Coronavirus contact-tracing: World split between two types of app, BBC News, 7th May 2020 https://www.bbc.co.uk/news/technology-52355028

[28] Busvine, D and Rinke, A (2020) Germany flips to Apple-Google approach on smartphone contact tracing ,Reuters, 28th April https://www.reuters.com/article/us-health-coronavirus-europe-tech/germany-flips-on-smartphone-contact-tracing-backs-apple-and-google-idUSKCN22807J

[29] Pullicino, E (2020) Coronavirus and contact tracing apps, Bristow's, 8th May 2020, https://www.bristows.com/news/coronavirus-and-contact-tracing-apps/

The EDPS has stated that:

> *'There is definitely a preference among data protection authorities for a decentralized approach, but we understand some countries and developers see the feasibility of some functionalities being carried centrally. We think it's something that's worth a try, but it has to be done with perfect control over the governments and authorities that will have a role in the solution.'* [30]

# 3. EU response to contact tracing apps

The EU commission has recognised that the development of digital solutions can have a significant impact on the treatment on COVID-19 and can play an important role in the strategy to lift containment measures. However, the use of digital technologies also presents significant technical and privacy challenges. Data and privacy laws in Europe are under increasing scrutiny as policy makers, governments and citizens attempt to understand what their rights and responsibilities are with regard to using mobile location data[31] In addition, while EU authorities are promoting a pan-European approach to app development they are also aware of the challenges that developing interoperable apps present, none more so than how to integrate the opposing decentralised and centralised architecture.

As a result, the Commission has undertaken a number of steps to promote an EU wide approach to the development and use of contact tracing apps, chief among which was the publication of a recommendation on the 8th of April to support COVID-19 digital tracking measures.

## 3.1 EU recommendation to support COVID-19 digital tracking measures

On the 8th of April the EU Commission published a recommendation for the use of technology and data to help predict the spread of COVID-19 in a data protection friendly manner.[32] Recommendations allow EU institutions to make their views known and to suggest a line of action without imposing any legal obligation on sates. They have no binding force.[33] The recommendation answered a call for a pan European effort, from member states and private organisations, to use the technology available for mapping, monitoring and containing the

[30] Duball, J (2020) Centralized vs. decentralized: EU's contact tracing privacy conundrum, April 20th 2020 https://iapp.org/news/a/centralized-vs-decentralized-eus-contact-tracing-privacy-conundrum/
[31] Mobile Location Data and Covid-19: Q&A, Human Rights Watch, May 13th 2020, https://www.hrw.org/news/2020/05/13/mobile-location-data-and-covid-19-qa
[32] Coronavirus Response: Digital technologies – innovative solutions during the coronavirus crisis, European Commission Website, https://ec.europa.eu/info/live-work-travel-eu/health/coronavirus-response/digital_en
[33] Types of EU Law, EU Commission, https://ec.europa.eu/info/law/law-making-process/types-eu-law_en

COVID-19 pandemic. The recommendation sets out two main priorities with regard to developing these digital measures[34]:

**(1) A pan-European approach for the use of mobile applications**, coordinated at Union level, including the development of a methodology for monitoring and sharing assessments of effectiveness of these applications, their interoperability and cross-border implications, and crucially their respect for security, privacy and data protection; and

**(2) A common scheme for using anonymized and aggregated data on mobility of populations** in order (i) to model and predict the evolution of the disease, (ii) to monitor the effectiveness of decision-making by Member States' authorities on measures such as social distancing and confinement, and (iii) to inform a coordinated strategy for exiting from the COVID-19 crisis.

Following the publication of the recommendation, EU Members States, supported by the Commission published two documents to support the recommendation, namely:

- An **EU 'Toolbox'** to guide the development of mobile applications; and
- A **set of guidelines** specifically focused on data protection and privacy issues that could arise with the use of apps.[35]

### 3.1.1 EU Toolbox for developing contact tracing apps

The toolbox sets out the essential requirements for development of COVID-19 related apps and reflects the best practices in the use of mobile contact tracing and warning apps to tackle the crisis. It covers several key aspects of the development of COVID-19 related apps including[36]:

- The epidemiological framework;
- Technical requirements;
- How to ensure interoperability across the EU;
- How to address accessibility;
- Governance;
- Exchange of information between Member States;
- Evaluating the performance of the apps; and

[34] Commission recommendation (EU) 2020/518 A common Union toolbox for the use of technology and data to combat and exit from the COVID19 crisis, in particular concerning mobile applications and the use of anonymised mobility data, Official Journal of the European Union https://eur-lex.europa.eu/eli/reco/2020/518/oj
[35] Covid-19 tracing apps: ensuring privacy and data protection, European Parliament News, 15th May 2020 https://www.europarl.europa.eu/news/en/headlines/society/20200429STO78174/covid-19-tracing-apps-ensuring-privacy-and-data-protection
[36] Mobile applications to support contact tracing in the EU's fight against COVID 19, eHealth Network, 15th April, 2020 https://ec.europa.eu/health/sites/health/files/ehealth/docs/covid-19_apps_en.pdf

- The prevention of non-official apps that could be harmful or contradict the common approach.

In addition to setting out functional and technological considerations the toolbox also recommends that the development of any apps should be guided by the following principles, namely that they are[37]:

- Voluntary;
- Approved by the national health authority;
- Privacy-preserving - personal data is securely encrypted; and
- Dismantled as soon as no longer needed.

### 3.1.2 Guidelines to ensure data protection and privacy for contact tracing apps

The EU Parliament has stressed that any digital measures against the pandemic must be fully compliant with data protection and privacy legislation, notably the General Data Protection Regulation (GDPR) and the ePrivacy Directive. Both sets of legislation provide the strongest safeguards for such digital measures to operate widely and accurately.[38]

The guidance that has been published alongside the EU toolbox aims to ensure that the data of European citizens is protected at all times during the development of new apps and the subsequent use of any data collected by national health authorities. The guidelines which are based on the GDPR and E-Privacy legislation set out a number of core principles, including[39]:

- The prominent role of National health authorities who should approve apps and be accountable for compliance with EU personal data protection rules;
- Users remain in full control of personal data. App installation should be voluntary and they should be discontinued as soon as no longer needed;
- Limited use of personal data. Only data relevant to the purpose in question, and should not include location tracking;
- Limits are placed on data storage. Personal data should be kept for no longer than necessary;
- Security of data. Data should be stored on an individual's device and encrypted;
- Interoperability. Apps should be usable in other EU countries as well; and
- National data protection authorities should be fully consulted and involved.

[37] Mobile applications to support contact tracing in the EU's fight against COVID 19, eHealth Network, 15th April, 2020 https://ec.europa.eu/health/sites/health/files/ehealth/docs/covid-19_apps_en.pdf
[38] Covid-19 tracing apps: ensuring privacy and data protection, European Parliament News, 15th May 2020, https://www.europarl.europa.eu/news/en/headlines/society/20200429STO78174/covid-19-tracing-apps-ensuring-privacy-and-data-protection
[39] Communication from the Commission Guidance on Apps supporting the fight against COVID 19 pandemic in relation to data protection, 2020/C 124 I/01, EU Commission Website https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1587141168991&uri=CELEX:52020XC0417(08)

## 3.2 Interoperability of contact tracing apps across EU borders

A major question mark attached to national coronavirus contact-tracing apps is whether they will function when citizens of one country travel to another. Currently, with many EU countries still in degrees of lockdown, cross border travel has been limited. However in recent weeks the European Commission has been focusing attention on supporting the tourism sector—proposing a tourism and transport package this week which sets out recommendations for a gradual and phased lifting of restrictions.[40]

Once borders begin to open the effectiveness of any national contact-tracing apps could be undermined if systems are not able to talk to each other. In the EU, this could mean, for example, a French citizen who travels to Germany for a business trip — where they spend time with a person who subsequently tests positive for COVID-19 — may not be warned of the exposure risk. Or vice versa.

Recognising this, on the 13th of May EU Member States, agreed to a set of interoperability guidelines for national apps The document sets out the intent for EU countries to work together so that different apps can share a minimum of data to enable exposure notifications across borders stating[41]:

> *Whatever the approach taken with approved apps, all Member States and the Commission consider that interoperability between these apps and between backend systems is essential for these tools to enable the tracing of cross-border infection chains.*

However, interoperability presents significant operational and technical challenges including how to get different health systems and apps that might be calculating risk exposure in slightly different ways to interface and share the relevant data in a secure way. This is compounded by the ongoing differences between countries over the core choice of app architecture for their national coronavirus contact tracing.[42]

Backers of the decentralised model have demonstrated that while it may be possible for interoperability between different *decentralised* tracing apps, interoperability between decentralised and centralised protocols, provides a significant challenge.[43] In the eHealth Network 'Interoperability guidelines' document, Member States agree that interoperability should happen regardless of which app architecture a European country has chosen but haven't identified a clear path for this to happen.[44]

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[40] Lomas, N (2020) How will Europe's contract tracing apps work across borders, Tech Crunch, 15th May 2020 https://techcrunch.com/2020/05/15/how-will-europes-coronavirus-contacts-tracing-apps-work-across-borders/
[41] Mobile applications to support contact tracing in the EU's fight against COVID 19, eHealth Network, 15th April, 2020 https://ec.europa.eu/health/sites/health/files/ehealth/docs/covid-19_apps_en.pdf
[42] Lomas, N (2020) How will Europe's contract tracing apps work across borders, Tech Crunch, 15th May 2020 https://techcrunch.com/2020/05/15/how-will-europes-coronavirus-contacts-tracing-apps-work-across-borders/
[43]Luckas, U et al (2020) Interoperability of Decentralized proximity tracing systems across regions, Version 2.2., 15th May 2020 https://drive.google.com/file/d/1mGfE7rMKNmc51TG4ceE9PHEggN8rHOXk/edit
[44] Interoperability guidelines for approved contact tracing mobile applications in the EU, eHealth Network, 13th May 2020 https://ec.europa.eu/health/sites/health/files/ehealth/docs/contacttracing_mobileapps_guidelines_en.pdf

## 3.4 Privacy risks of interoperable contact tracing apps

Academics also highlight the privacy risks of interoperable apps highlighting that while interoperability between decentralised and centralised systems is possible in principle, it introduces substantial privacy concerns. Decentralised systems have been designed specifically to avoid the ability of a central authority to be able to recover the identity of users. Trying to merge this with a centralised system cannot happen without severely weakening the privacy of users of the decentralised system.[45]
Developers have also discussed how in a centralised system a person may trust their own government to handle their sensitive health data but they may be less inclined to trust another country's government with a similar app architecture. In addition, where citizens are using a decentralised app, they may not want to engage with an app that uses a centralised system. As a result, it remains to be seen whether citizens would even be willing to use their app across borders if they were unsure of the level of privacy they are being afforded.[46]

## 3.5 Further developments at an EU level

In a resolution adopted on 17 April and during a plenary debate on 14 May, Parliament further stressed that any digital measures against the pandemic must be in full compliance with data protection and privacy legislation. It said the use of apps should not be obligatory and that they should include sunset clauses so that they are no longer used once the pandemic is over.[47] MEPs also stressed the need for anonymised data and said that to limit the potential risk of abuse, the generated data should not be stored in centralised databases. In addition, MEPs said it should be made clear how the apps are expected to help minimise infection, how they are working and what commercial interests the developers have.[48]

Commentators have suggested that the steps taken by the EU Commission to support the development of European tracing apps does not go far enough and the EU should consider implementing legislation that prevents apps from entering the EU market that do not respect European privacy rules.[49]

[45] Lomas, N (2020) How will Europe's contract tracing apps work across borders, Tech Crunch, 15th May 2020 https://techcrunch.com/2020/05/15/how-will-europes-coronavirus-contacts-tracing-apps-work-across-borders/
[46] Lomas, N (2020) How will Europe's contract tracing apps work across borders, Tech Crunch, 15th May 2020 https://techcrunch.com/2020/05/15/how-will-europes-coronavirus-contacts-tracing-apps-work-across-borders/
[47] European Parliament resolution of 17 April 2020 on EU coordinated action to combat the COVID-19 pandemic and its consequences (2020/2616(RSP), European Parliament, 17th April 2020 https://www.europarl.europa.eu/doceo/document/TA-9-2020-0054_EN.pdf
[48] European Parliament resolution of 17 April 2020 on EU coordinated action to combat the COVID-19 pandemic and its consequences (2020/2616(RSP), European Parliament, 17th April 2020 https://www.europarl.europa.eu/doceo/document/TA-9-2020-0054_EN.pdf
[49] Lomas, N (2020) EU privacy body urges annonymisation of location data for COVID-19 tracking, May 15th 2020 https://techcrunch.com/2020/04/22/eu-privacy-body-urges-anonymization-of-location-data-for-covid-19-tracking/

# 4. The UK's Centralised NHS COVID-19 app

Informed by the study conducted in Oxford University, which demonstrated that apps could help to significantly slow the rate of transmission, and support countries to emerge from lockdowns safely, the UK was one of the first European countries to explore the use of a contact tracing app.[50] However, unlike the majority of European countries, the UK has to date persisted with using a centralised model which is currently undergoing an initial trial on the Isle of Wight. The app which is being developed by NHSX, the health service's digital innovation unit, follows the same path of other centralised systems where the contact-matching process happens on a UK-based NHS computer server rather than individuals' smartphones. Similar to the experience of other countries who have introduced centralised apps, the NHS app is facing significant technical issues as well as concerns around data security.

## 4.1 Privacy Concerns and the NHS COVID-19 App

The development of the app has been dogged with questions concerning privacy measures and the security of user's data. Notably at a session of the Joint Human Rights Committee, the apps developers admitted that despite the app anonymising users' identities, they could in theory be re-identified, which might allow the authorities - or hackers - to reveal people's social circles for other purposes.[51] The committee also heard from the Information Commissioners office (ICO) who oversee privacy and GDPR legislation in the UK that the government had not submitted a data protection impact assessment, which is a legally required step for any organisation embarking on "high risk" data processing.[52]

At the same time a legal letter published by the Open Rights group, a collection of civil liberties and privacy groups, expressed 'heightened and urgent concerns' that the government had failed to follow laws requiring it to submit an assessment of the risks to the ICO and that in effect the current trial underway the Isle of Wight is unlawful under the Data Protection Act.[53]

As a result the Joint Human Rights Committee has stated that it is not enough for the government to simply provide assurance that citizens data is safe and strongly recommended that the government should provide a robust legal framework to ensure security of users data as well as establishing a new watchdog to oversee use of the app and the measures taken to keep the data safe.[54] To date the government has not responded to this request but has re-iterated that:

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[50] Controlling coronavirus using a mobile app to trace close proximity contacts, University of Oxford, 2nd April 2020 http://www.ox.ac.uk/news/2020-04-02-controlling-coronavirus-using-mobile-app-trace-close-proximity-contacts

[51] Coronavirus: NHS reveals source code behind contact-tracing app, BBC News, 7th May 2020, https://www.bbc.co.uk/news/technology-52579547

[52] Syal, R (2020) UK contact-tracing app could fall foul of privacy law, government told, The Guardian, Tuesday 7th May 2020, https://www.theguardian.com/world/2020/may/07/uk-coronavirus-contract-tracing-app-could-fall-foul-of-privacy-law-government-told

[53] Clark, L (2020) Open letter from digital rights groups to UK health secretary questions big tech's role in NHS COVID-19 data store, Tuesday 19th May 2020 https://www.theregister.co.uk/2020/05/19/covid19_nhs_data_store_open_letter/

[54] Kelion, L (2020) Coronavirus: NHS reveals source code behind contact-tracing app, BBC News, 7th May 2020 https://www.bbc.co.uk/news/technology-52579547

> *'Security and privacy had been prioritised during the app's development and that users can delete the app and its data whenever they want and we will always comply with relevant laws, including the Data Protection Act.'*[55]

A major concern of privacy groups from the outset in relation to development of contact tracing apps is what will happen to any data that is collected once the pandemic has passed. The UK government has been asked to indicate whether the data would be destroyed at the end of the pandemic by invoking a 'sunset clause' similar to the approach taken by the Australian government.[56] In response, the government has indicated that it has not ruled out incorporating this type of clause, however, it has also indicated that it plans on holding on to some data after the pandemic because it allows the NHS to track regional outbreaks and obtain information about the future spread of the disease[57].

Civil liberties and privacy groups have also stated that large-scale contact tracing is too sensitive to rely on trust alone. The app will need a high take up among users for it to be worthwhile and the government will need to provide complete transparency regarding its use of the data and how the app works to ensure public confidence in its privacy measures.[58]

In response the National Cyber Security Centre (NCSC) has produced a blog paper[59] to explain to the general public how the app will work and a technical paper detailing the privacy and security design of the NHS contact tracing app.[60]

## 4.2 Technical concerns and the NHS COVID-19 App

The primary technical difficulty that centralised apps, including the NHS COVID-19 App, face is how they work on IOS (Apple) and android (Google) systems. As android and apple phones occupy the majority of the smartphone market, compatibility is crucial.

This was an early problem discovered by the centralised Singapore app Trace Together when developers discovered that the software for the app needed to be actively running with the phone unlocked for the tracing function to work. As a result, the Singapore government had to ask users to keep their phone open and app running as much as possible. The inconvenience

[55] Syal, R (2020) UK contact-tracing app could fall foul of privacy law, government told, The Guardian, Tuesday 7th May 2020, https://www.theguardian.com/world/2020/may/07/uk-coronavirus-contract-tracing-app-could-fall-foul-of-privacy-law-government-told
[56] Provisos for a Contact Tracing App. The route to trustworthy digital contact tracing, Ada Lovelace Institute, 5th May 2020 https://www.adalovelaceinstitute.org/wp-content/uploads/2020/05/Ada-Lovelace-Institute-Provisos-for-a-Contact-Tracing-App-4-May-2020.pdf
[57] Sabbagh, D (2020) UK racing to improve contact-tracing app's privacy safeguards, The Guardian, 5th May 2020, https://www.theguardian.com/technology/2020/may/05/uk-racing-to-improve-contact-tracing-apps-privacy-safeguards
[58] De Montjoye, YA (2020) Evaluating COVID-19 contact tracing apps? Here are 8 privacy questions we think you should ask, Computational Privacy Group, April 2nd 2020 https://cpg.doc.ic.ac.uk/blog/evaluating-contact-tracing-apps-here-are-8-privacy-questions-we-think-you-should-ask/
[59] Levy, I (2020) The security behind the NHS contact tracing app, National Cyber Security Centre, 4th May 2020 https://www.ncsc.gov.uk/blog-post/security-behind-nhs-contact-tracing-app
[60] Levy, I (2020) High level privacy and security design for NHS COVID-19 contact tracing app, National Cyber Security Centre, 3rd May 2020 https://www.ncsc.gov.uk/report/nhs-covid-19-app-privacy-security-report

this created for the average iPhone user was stated as one of the reasons for its low adoption rate.[61]

Learning from the issues raised by the Singapore app the developers at NHXS created a workaround to this problem by using a different type of bluetooth signal than the one being used by the Singapore app to log contacts. This means that the app can listen passively for other Bluetooth devices in the background and then wake up in order to register other bluetooth signals around it. As a result, the phone does not need to be unlocked with the app constantly running on the background.[62] However there are ongoing questions over how robustly it will perform in practice.

Technical experts have also identified that iPhones using the app will fail to wake each other up to exchange bluetooth signals unless there is also an Android device in the vicinity. This has the potential to result in big gaps in the tracing data given that around 40% of UK smartphones are apple devices.[63] To avoid this the app will need to rely on 'Android herd immunity' where a critical mass of Android users will be required to ensure iPhone owners remain covered by the app's contact-tracing ability. If not enough Android users are in any given community, iPhones will eventually stop broadcasting the signals required for the app to work.[64]

Battery drain may also be an issue with the UK system, though the NHSX has claimed its workaround solves this. However, being outside the Apple-Google platform means that the workarounds developed by the UK app could be rendered useless if there are any future platform updates to the Apple-Google system. [65]

Finally, experts also cautioned that as many as 10 million people in the UK risk being 'locked out' of using the app because of the "digital divide". The Commons culture, media and sport committee heard that almost 2 million households do not have internet access and that a further 7 million may have used the net, but only have very basic skills and may not know how to use an app.[66]

[61] Lomas, N (2020) NHS COVID-19: The UK's coronavirus contacts-tracing app explained, Tech Crunch, May 5th 2020 https://techcrunch.com/2020/05/05/nhs-covid-19-the-uks-coronavirus-contacts-tracing-app-explained/
[62] Lomas, N (2020) NHS COVID-19: The UK's coronavirus contacts-tracing app explained, Tech Crunch, May 5th 2020 https://techcrunch.com/2020/05/05/nhs-covid-19-the-uks-coronavirus-contacts-tracing-app-explained/
[63] McCarthy, K (2020) UK finds itself almost alone with centralized virus contact-tracing app that probably won't work well, asks for your location, may be illegal, The Register, 5th May 2020 https://www.theregister.co.uk/AMP/2020/05/05/uk_coronavirus_app/
[64] Hern, A and Sabbagh, D (2020) Critical mass of Android users crucial for NHS contact-tracing app, The Guardian, 7th May 2020 https://www.theguardian.com/world/2020/may/06/critical-mass-of-android-users-needed-for-success-of-nhs-coronavirus-contact-tracing-app
[65] Lomas, N (2020) NHS COVID-19: The UK's coronavirus contacts-tracing app explained, Tech Crunch, May 5th 2020 https://techcrunch.com/2020/05/05/nhs-covid-19-the-uks-coronavirus-contacts-tracing-app-explained/
[66] Thompson, J (2020) 'Exit' From COVID-19 'Lockdown': Health-Related Issues, Northern Ireland Assembly Research and Information Services Briefing Paper, May 19th 2020 http://www.niassembly.gov.uk/globalassets/documents/raise/publications/2017-2022/2020/health/2220.pdf

## 4.3 NHS COVD-19 app and interoperability with other tracing apps

Perhaps most pressing of all, is the interoperability of the app with the decentralised apps being used by other countries. The EU commission has repeatedly highlighted the importance of a single European approach to app development in order to ensure that borders can open. With no obvious way for centralised vs decentralised systems to work in tandem, questions remain over what happens when UK citizens want to travel to countries with decentralised systems and vice versa. [67] Notably, the Republic of Ireland has elected to use a decentralised app, if Northern Ireland chooses to adopt the NHS centralised app, there are risks that the two systems will not be interoperable and travellers may have to use multiple apps.[68]

Robin Swann, Health Minister for Northern Ireland has expressed his preference for a single app that could be used across the UK and Northern Ireland and his officials are "still looking to see which will be the best fit" for Northern Ireland. However, their current focus is on contact tracers, rather than relying on an app. The Department of Health has said it is also taking forward work around "digital solutions" that can support the wider contact tracing programme.[69]

In Scotland, the First Minister, Nicola Sturgeon, recently expressed caution around the use of the app and said that it will be available in Scotland, but the country will not be "building a whole system around it". She intends that the Scottish NHS will rely on specialist contract tracers who will directly inform a patient's contacts. The First Minister for Wales, Mark Drakeford, has stated that Wales was looking at exploring the technology to see whether they can make use of it in Wales.[70]

## 4.4 Initial results from the Isle of Wight NHS App Trial

The initial results from the Isle of Wight COVID-19 app trial suggest that user engagement has been positive. Epidemiologists suggest that for the UK as a whole, about 60% of the population needs to install and use the software for it to live up to its full potential.[71]

Initial figures suggest that the app has had roughly 60,000 downloads among the Island's population of 140,000. This is further bolstered by the fact that its inhabitants are slightly

[67] Lomas, N (2020) NHS COVID-19: The UK's coronavirus contacts-tracing app explained, Tech Crunch, May 5th 2020 https://techcrunch.com/2020/05/05/nhs-covid-19-the-uks-coronavirus-contacts-tracing-app-explained/
[68] Lomas, N (2020) UK's NHS COVID-19 app lacks robust legal safeguards against data misuse, warns committee Tech Crunch, May 7th 2020 https://techcrunch.com/2020/05/07/uks-nhs-covid-19-app-lacks-robust-legal-safeguards-against-data-misuse-warns-committee/
[69] McCormack, J (2020) Coronavirus Q&A: What is NI's contact tracing plan? BBC News, 20th May 2020 https://www.bbc.co.uk/news/uk-northern-ireland-52736896
[70] Thompson, J (2020) 'Exit' From COVID-19 'Lockdown': Health-Related Issues, Northern Ireland Assembly Research and Information Services Briefing Paper, May 19th 2020 http://www.niassembly.gov.uk/globalassets/documents/raise/publications/2017-2022/2020/health/2220.pdf
[71] Coronavirus research, digital contact tracing can slow or even stop coronavirus transmission and ease us out of lockdown, Oxford University, 16th April 2020 https://www.research.ox.ac.uk/Article/2020-04-16-digital-contact-tracing-can-slow-or-even-stop-coronavirus-transmission-and-ease-us-out-of-lockdown

older and less likely to own a smartphone than the UK average.[72] While some of that 60,000 may include some who have downloaded the app twice or are from the mainland, the figures still compare favourably to other countries using centralised apps including Singapore where 20% of the population downloaded the contact tracing app as well as Australia where the app was downloaded by roughly a quarter of the population.[73]

However, some difficulties have been identified during the trial including:

- **The limited number of cases on the Isle of Wight:** With only 173 confirmed cases of Covid-19 on the Island and most people still in lockdown, it is quite unlikely that any single individual using the app would have come into contact with an infected person;
- **The Symptoms list:** The app only asks someone who feels unwell about two symptoms - a high temperature and a continuous cough;
- **Ambiguous health guidance:** People may or may not be sent for a test depending on their symptoms and anyone whom they recently came into proximity with may be sent alerts, warning them to be 'careful' and be on the lookout for their own symptoms; and
- **Action regarding test results:** The app does not allow users to enter a test result, positive or negative, meaning their contacts are left in limbo as to whether and for how long they should self-isolate.

## 4.5 Is the UK Government moving towards a decentralised model?

The difficulties posed by the trial combined with the overall technical difficulties of the centralised operating system and the ongoing privacy concerns have according to media reports led the government to consider switching its approach to a decentralised app.

Health chiefs in the UK have tasked a team of software developers to 'investigate' the possibility of switching its contact-tracing app to the global standard proposed by Apple and Google.[74] The government has yet to confirm this but Matthew Gould, head of NHSX, has stated that the decision to build the app without the involvement of Google and Apple was not fixed in stone[75]:

> *'If it becomes clear that a different approach is a better one and achieves the things that we need to achieve more effectively, we will change. We are*

[72] Cellan-Jones, R (2020) Coronavirus: Isle of Wight contact-tracing app trial - a mixed verdict so far, BBC News, 18th May 2020 https://www.bbc.co.uk/news/technology-52709568
[73] Dennis JS Et al (2020) 70% of people surveyed said they'd download a coronavirus app. Only 44% did. Why the gap? The Conversation, May 15th 2020, https://theconversation.com/70-of-people-surveyed-said-theyd-download-a-coronavirus-app-only-44-did-why-the-gap-138427
[74]Hearn, A and Proctor, K (2020 UK may ditch NHS contact-tracing app for Apple and Google model, The Guardian, 7th May 2020 https://www.theguardian.com/technology/2020/may/07/uk-may-ditch-nhs-contact-tracing-app-for-apple-and-google-model
[75]Hearn, A and Proctor, K (2020 UK may ditch NHS contact-tracing app for Apple and Google model, The Guardian, 7th May 2020 https://www.theguardian.com/technology/2020/may/07/uk-may-ditch-nhs-contact-tracing-app-for-apple-and-google-model

*not particularly wedded to a single approach. It is a very pragmatic decision about which approach is likely to get the results that we need.'*

## 4.6 Are governments losing faith in contact tracing apps?

Despite initially pledging to have the NHS COVID app ready for use by the middle of May, the government has stated that the original date is no longer achievable due to technical issues and a launch at the beginning of June is a more likely scenario. The Government has also been placing less focus on the app as the pillar of their testing and tracking program.[76]

The French and Italian government has also been forced to delay deployment of their planned contact-tracing apps. Initially expected in mid may as the country started lifting confinement measures, French authorities have stated their app won't be ready until June. The Italian Premier Giuseppe Conte has stated that following a delay the country's contact-tracing app would begin tests soon but he did not provide additional detail as to how this was being rolled out. [77]

Spain is making preparations to test their app at the end of June in the Canary Islands but the adoption of the app has taken a back seat to the hiring of a manual contact tracing team. The government has said that the technology will be adopted only if it adds value to the tracing efforts that are being deployed by the country's 17 regional administrations.[78]

# 5. Big data analytics and COVID-19

In addition to using mobile data for contact tracing apps, governments and health authorities are also analysing large sets of mobile location data supplied by telecoms companies. The purpose of the data is to better understand general patterns of people's movements and behaviours during the COVID-19 pandemic and how these have changed over time. Such analysis of 'big data' aims to forecast how the virus might be spreading and the effectiveness of public health interventions such as social distancing measures and to identify ways to better allocate testing and medical resources.[79]

The ability for governments to request mobile location datasets and the willingness of telecoms companies to provide the data has raised concerns for privacy. In response, telecoms companies have been keen to stress that any mobile data they are providing is

[76] Knowles, T (2020) Rollout of NHS Covid-19 app delayed, admits minister, The Times, May 20th 2020 https://www.thetimes.co.uk/article/minister-admits-delay-in-app-rollout-6r0f6tdz3
[77] European Plans to Use Apps in Virus Tracking Face Setbacks, VOA News, May 21st 2020 , https://www.voanews.com/covid-19-pandemic/european-plans-use-apps-virus-tracking-face-setbacks
[78] Elelman, C (2020) Spain's residents on Costa Blanca and Costa del Sol watch on as Government reveals plans to test coronavirus contact tracking app on Canary Islands, Euro Weekly News, 21st May 2020 https://www.euroweeklynews.com/2020/05/21/spains-residents-on-costa-blanca-and-costa-del-sol-watch-on-as-government-reveals-plans-to-test-coronavirus-contact-tracking-app-on-canary-islands/
[79] Mobile Location Data and Covid-19: Q&A, Human Rights Watch, 17th May 2020, https://www.hrw.org/news/2020/05/13/mobile-location-data-and-covid-19-qa

aggregated and anonymised as well as being provided in past rather than real time. The companies argue that the data is solely for the purpose of showing generalised patterns in the movement of people and provides no individual identifiers. [80]

## 5.1 What is mobile location data and how is it gathered?

The proliferation of smartphone devices have enabled companies that track location data to understand how citizens behave and move in the real-world. Location data is geographical information about a specific device's whereabouts associated to a time identifier. The process of collecting location data requires a number of different factors including[81]:

**A location signal:** Location signals come from a variety of sources including WIFI, Bluetooth, GPS and Mobile phone towers, each of which produces signals which the device listens for and uses to establish a geographic position.

Location data supplied by telecoms companies usually comes from mobile phone towers. Mobile devices are usually connected to cell towers so that they can send and receive phone calls and messages. A device can often identify multiple cell towers and by triangulation, based on signal strength, can be used to place a device location.

**An identifier:** Each smartphone needs to be associated with an identifier to understand movement over time. This identifier is called a device ID.

**Meta data or additional datasets:** Location signal combined with an identifier will allow you to see the movement of a device over time. However, for more detailed insights and to get more value from location data, data analysts will usually add some metadata or an additional dataset. These datasets include points of interest that are important when tracking the movement and behaviours of people. For example, a series of latitudes and longitudes showing how people move during commute times could be useful. However, by tying it to a dataset that records use of public transport and key travel routes, the data could indicate how commuting numbers and patterns have increased or decreased at various stages of the pandemic.

## 5.2 How do companies anonymise mobile location data?

Anonymisation of data is a technique used by telecoms companies to eliminate the risk of any one individual being identified from a dataset. There are several different types of

[80] Fildes, N and Espinoza, J (2020) Tracking coronavirus: big data and the challenge to privacy, The Financial Times, April 8th 2020, https://www.ft.com/content/7cfad020-78c4-11ea-9840-1b8019d9a987

[81] Ewen, J (2019) Best Guide To Location Data 2020 – All You Need To Know, Tamoco, September 4th 2019, https://www.tamoco.com/blog/location-data-info-faq-guide/#What_is_location_data

techniques most of which fall into one of three categories: cryptographic, generalisation and randomisation[82]:

- **Cryptographic methods:** encrypt the information while it is being stored which protects the data but means re-identification can happen when the data is decrypted for processing;
- **Generalisation techniques**: deliberately remove identifiers and reduce precise data. Under generalization, for example, an individual's height or weight becomes a range, instead of the exact number; and
- **Randomisation** skews the results by adding data and moving elements around so that re-identification results are full of errors.

Aggregation of data, a term which telecoms companies also use when discussing the security of their data refers to information that is only viewable in groups and as part of a summary, not per the individual. With aggregate data, governments and health authorities cannot access the raw information. Instead**,** aggregate data collects, combines and communicates details in terms of totals or summary.[83]

An anonymised dataset is supposed to have had all personally identifiable information removed from it, while retaining a core of useful information for researchers to operate on without fear of invading privacy. For instance, a hospital may remove patients' names, addresses and dates of birth from a set of health records so researchers can use the records to uncover hidden links between conditions. Privacy groups argue that in practice, data can be deanonymised in a number of ways and none of the anonymisation techniques detailed above provide completely risk free privacy and question whether current practices satisfy the anonymisation standards of modern data protection laws including GDPR.[84] Privacy campaigners worry that handing over such personally identifying information in large quantities crosses a line that may be hard to step back from when things return to normality.[85]

## 5.3 Data protection and the use of telecoms location data

Aggregated anonymised location data which does not enable identification of any individual are not considered personal data and therefore EU GDPR rules do not apply. However, the European Data Protection Supervisor (EDPS) has cautioned that while anonymised data fall outside of the scope of data protection legislation effective anonymisation requires more than

[82] McIntosh, V (2019) Understanding aggregate, de-identified and anonymous data, October 25th 2019, https://www.comparitech.com/blog/information-security/aggregate-vs-anonymous-data/#Why_we_may_need_to_give_up_the_idea_of_anonymous_data_altogether
[83] McIntosh, V (2019) Understanding aggregate, de-identified and anonymous data, October 25th 2019, https://www.comparitech.com/blog/information-security/aggregate-vs-anonymous-data/#Why_we_may_need_to_give_up_the_idea_of_anonymous_data_altogether
[84] Alex Hearne (2019) 'Anonymised' data can never be totally anonymous, says study, The Guardian, 23rd July 2019 https://www.theguardian.com/technology/2019/jul/23/anonymised-data-never-be-anonymous-enough-study-finds
[85] Sweney, M and Hern, A (2020) Phone location data could be used to help UK coronavirus effort, The Guardian, https://www.theguardian.com/world/2020/mar/19/plan-phone-location-data-assist-uk-coronavirus-effort

simply removing identifiers such as phone numbers. Any data shared with third parties needs to be fully anonymised and aggregated to ensure it cannot be traced back to individuals. [86]

The EDPS also stressed that where the Commission is relying on third parties to analyse anonymised data on their behalf they must ensure that those third parties process the data in a way that complies with strict information security and confidentiality obligations. Finally, the EDPS expressed a preference that access to this type of data would be limited to authorised experts in spatial epidemiology, data protection and data science.[87]

# 6. A closer look at how big data is being used in Europe

This is not the first time that big data from telecoms companies has been used to track disease outbreaks. Several international telecoms companies including Vodafone have experience of working with local governments and international health agencies using this type of data to track the spread of infectious diseases in the developing world.[88] In Africa in particular, aggregated mobile data has been used to track malaria in order to identify areas with large medical needs and to track future potential outbreaks.[89] Understandably, EU governments are keen to use mobile data in the same way to track the spread of COVID-19.

## 6.1 Telecoms data informs government responses to COVID-19

Mobile phone carriers have increasingly been sharing mobile data with individual EU governments to assist with tracking COVID-19. The use of this type of data has been applied in Italy, Spain, Norway, Germany, Austria and Belgium and more recently the UK, Portugal and Ireland.[90] Up until now, the datasets which are anonymous and aggregated, have allowed counties to examine how social distancing and containment measures or 'lockdowns' have been working by mapping concentrations and movements of their customers in Covid-19 hotspots.

In Germany, data shared by Deutsche Telekom provided insights as to whether citizens were complying with lockdown measures during the peak of the epidemic. Similarly, in the Lombardy region of Italy, where over half of the country's cases occurred, data from Telecom

[86] EDPS Comments to DG Connect of the European Commission on the monitoring of COVID-19 spread, Subject: Monitoring spread of COVID-19, European Data Protection Supervisor, 25th March 2020 https://edps.europa.eu/sites/edp/files/publication/20-03-25_edps_comments_concerning_covid-19_monitoring_of_spread_en.pdf

[87] EDPS Comments to DG Connect of the European Commission on the monitoring of COVID-19 spread, Subject: Monitoring spread of COVID-19, European Data Protection Supervisor, 25th March

[88] Wall, M (2014) Ebola: Can big data analytics help contain its spread? BBC News Website 15th October 2014 https://www.bbc.co.uk/news/business-29617831

[89] Wesolowski et al. (2012) Quantifying the Impact of Human Mobility on Malaria. Science. 338(6104):267-70. https://science.sciencemag.org/content/338/6104/267.long

[90] Espinosa, J and Fildes, N (2020) Tracking coronavirus: big data and the challenge to privacy. Financial Times April 8th 2020 https://www.ft.com/content/7cfad020-78c4-11ea-9840-1b8019d9a987

Italia, Vodafone and WindTre were able to show how many people were observing a strict lockdown. The data was able to demonstrate that movements exceeding 300-500 metres were down by around 60%.[91]

Telecoms companies in Spain were able to show that the movement of people in one city dropped by 90 per cent during the first week of the lockdown and in Belgium, data supplied by Proximus SA showed that long distance trips of more than 40km dropped 95 per cent after confinement measures were introduced.[92]

European governments have been quick to stress that the data is being used in an appropriate manner with no threat to individual privacy. Belgian authorities have said that data will be destroyed once it is no longer needed and an ethics committee had been established to monitor how the data is being used. Similarly, Germany's federal data-protection authority has stated that the anonymization methods used by Deutche Telecom ensure privacy.[93]

## 6.2 EU keen to pool large amounts of European telecoms data

The EU has also recognised the potential to track the spread of the virus through this type of anonymised digital information. In March the Commission entered into negotiations with several European telecoms companies with the aim of pooling large amounts of European mobile data.[94] The commission stated that accurate, up to date information on aggregated mobility patterns could be potentially vital for monitoring, predicting outbreaks, and planning future resource needs such as testing kits, beds, medical staff and equipment.[95] The aim of the Commission is to have one carrier per EU Member State providing anonymized and aggregated data.[96] Following discussions, eight major providers agreed to assist the EU by providing data. The Commission said that in order to protect privacy it will only use anonymised and aggregated mobile phone data and confirmed it will delete any data it acquires once the epidemic has passed.[97] While anonymised data falls outside the scope of EU data protection laws, the EDPS has confirmed that the project does not breach privacy rules as long as there are safeguards in place.[98] The EDPS has also stated that trust of the public is crucial in any type of project of this nature and that:

[91] European mobile operators share data for coronavirus fight https://www.reuters.com/article/us-health-coronavirus-europe-telecoms/european-mobile-operators-share-data-for-coronavirus-fight-idUSKBN2152C2
[92] Espinosa, J and Fildes, N (2020) Tracking coronavirus: big data and the challenge to privacy. Financial Times April 8th 2020 https://www.ft.com/content/7cfad020-78c4-11ea-9840-1b8019d9a987
[93] Stupp, C (2020) Europe tracks residents phones for coronavirus research, Wall Street Journal, March 27th 2020 **LINK**
[94] Scott, M et al (2020) Commission tells carriers to hand over mobile data in coronavirus fight, Politico.EU Website 25th March 2020 https://www.politico.eu/article/european-commission-mobile-phone-data-thierry-breton-coronavirus-covid19/
[95] GSMA Website (2020) COVID-19 Privacy Guidelines. https://www.gsma.com/publicpolicy/resources/covid-19-privacy-guidelines. Accessed 15.05.20
[96] Lomas, N (2020) Google is now publishing coronavirus mobility reports, feeding off users' location history. April 3rd 2020. Tech Crunch. https://techcrunch.com/2020/04/03/google-is-now-publishing-coronavirus-mobility-reports-feeding-off-users-location history/
[97]Chee, F Y (2020) Vodafone, Deutsche Telekom, 6 other telcos to help EU track virus Reuters Website. March 25th 2020 https://www.reuters.com/article/us-health-coronavirus-telecoms-eu/vodafone-deutsche-telekom-6-other-telcos-to-help-eu-track-virus-idUSKBN21C36G
[98] Chee, F Y (2020) Vodafone, Deutsche Telekom, 6 other telcos to help EU track virus Reuters Website. March 25th 2020 https://www.reuters.com/article/us-health-coronavirus-telecoms-eu/vodafone-deutsche-telekom-6-other-telcos-to-help-eu-track-virus-idUSKBN21C36G

> *'The Commission should clearly define the dataset it wants to obtain and ensure transparency towards the public, to avoid any possible misunderstandings'*[99]

## 6.3 Internet Companies and the role of big data

It is not just mobile phone operators that are sharing datasets that track location information. Both Facebook and Google are providing information for the purposes of analysing mobility patterns.

### 6.3.1 Google Mobility Reports

Google has been producing what it calls mobility reports since the beginning of the pandemic. The reports demonstrate aggregated changes in population movements around the world. They are based on an in-house analysis of the granular location data it maps and tracks to inform its ad-targeting, product development and wider commercial strategy. Google has stated that it will produce the reports for a global audience (currently reporting on 131 countries) and will continue to publish them as long as governments and health authorities find them useful.[100] The company has declared that the reports could help government and public health officials:

> *'Understand changes in essential trips that can shape recommendations on business hours or inform delivery service offerings. Similarly, persistent visits to transportation hubs might indicate the need to add additional buses or trains in order to allow people who need to travel room to spread out for social distancing'*[101]

The insights are created using aggregated, anonymized sets of data from users who have turned on the Location History setting on their phone, which is off by default. Google uses what it terms 'differential privacy' to ensure the privacy and security of its user data. [102]

[99] Stolton, S (2020) Digital Brief: Data for the Common Good? Euractive Website. March 26th 2020 https://www.euractiv.com/section/digital/news/digital-brief-data-for-the-common-good/
[100] Fitzpatrick, J and De Salvo, K (2020) Helping public health officials combat COVID-19. The Keyword Blog. https://www.blog.google/technology/health/covid-19-community-mobility-reports.
[101] Lomas, N (2020) Google is now publishing coronavirus mobility reports, feeding off users' location history. April 3rd 2020. Tech Crunch. https://techcrunch.com/2020/04/03/google-is-now-publishing-coronavirus-mobility-reports-feeding-off-users-location history/
[102] Koksal, I (2020) Google Starts To Publish Coronavirus Mobility Reports. Forbes.com April 7th 2020 https://www.forbes.com/sites/ilkerkoksal/2020/04/07/google-starts-to-publish-coronavirus-mobility-reports/#343030e15a32

### 6.3.2 Facebook data for good

Facebook is also contributing data through its 'Data for Good' program. The programme was initiated in 2017 to help track evacuations and displacement after natural disasters. It has since expanded to address disease and, most recently, COVID-19. The company gathers its information from people using Facebook on their mobile phones who have the location history feature enabled.[103] Facebook is currently providing mobility datasets and maps directly to 150 different researchers and NGO's upon request, generating the data in file formats that support epidemiological models.[104] For example, researchers in Italy have used Facebook's mobility data to analyse how lockdown orders affect economic conditions and create an economic segregation effect.[105] The company reports that all data is anonymised and aggregated to protect individual privacy.[106]

## 6.4 How are the UK using big data?

Similar to other European countries, the UK government have also been making use of location data to track how social distancing measures are being followed, particularly in London. Two major telecoms companies, O2 and EE have confirmed that they are providing aggregated data to the government. The government's initial use of the data has been to observe trends in public movements during lockdown and identify whether additional services or enforcements are necessary.[107] Both companies have stressed that any data they provide is anonymised and aggregated and does not provide any identifiable information.

The government has also expressed support for the use of other forms of big data including google mobility reports with culture Secretary Oliver Dowden stating:

> *"We're working closely with tech companies to find innovative ways to stop the spread of coronavirus, protect the NHS and save lives. Google's publication of COVID-19 mobility reports will help improve our understanding of the impact of the social distancing measures."*[108]

[103] Waltz, E (2020) How Facebook and Google Track Public's Movement in Effort to Fight COVID-19, IEEE Spectrum, 16th April 2020 https://spectrum.ieee.org/the-human-os/telecom/wireless/facebook-google-data-publics-movement-covid19
[104] Newton, K (2020) Facebook begins sharing more location data with COVID-19 researchers and asks users to self-report symptoms, TechCrunch, April 6th 2020 https://www.theverge.com/facebook/2020/4/6/21209733/facebook-disease-prevention-maps-covid-19-symptom-reports-privacy
[105] Waltz, E (2020) How Facebook and Google Track Public's Movement in Effort to Fight COVID-19. 16th April 2020. IEEE Spectrum Website. https://spectrum.ieee.org/the-human-os/telecom/wireless/facebook-google-data-publics-movement-covid19
[106] Our work on COVID-19, Facebook Data for good, https://dataforgood.fb.com/docs/covid19/
[107] Alexander, M (2020) Coronavirus: Government using mobile location data to tackle outbreak, Sky News Website, 19th March 2020 https://news.sky.com/story/coronavirus-government-using-mobile-location-data-to-tackle-outbreak-11960050
[108] Aguilar-Garcia (2020) Coronavirus: Google data shows how people's movements have changed since outbreak. Wednesday 8th April 2020 https://news.sky.com/story/coronavirus-trips-to-the-shops-fall-by-85-since-outbreak-according-to-google-data-11968171

In late March, it was also revealed that the NHS would be partnering with Google, Amazon, American data-processing firm Palantir and Faculty, a British intelligence start-up, to develop a shared data platform to assist in Covid-19 surveillance.[109]

Palantir is helping to consolidate government databases and help ministers and officials respond to the pandemic. Data is also being used by Faculty to build predictive computer models around the Covid-19 outbreak. NHSX, the digital transformation arm of the National Health Service that has contracted the tech companies to help build the 'Covid-19 datastore', said the technology would give ministers and officials

> *"Real-time information about health services, showing where demand is rising and where critical equipment needs to be deployed".*

However, they stressed that the companies involved do not control the data, are not permitted to use or share it for their own purposes and only had access to aggregated or anonymised data via NHS systems.

Despite government assurances, there have been media reports that the project includes large volumes of data pertaining to individuals, including protected health information, Covid-19 test results, the contents of people's calls to the NHS health advice line 111 and clinical information about those in intensive care. While such data will be anonymised, it remains sensitive and confidential, and its use on a centralised new government database is likely to raise questions among privacy experts.[110]

## 6.5 Why are privacy bodies concerned about the use of big data?

While policymakers have been advocating the use of big data to inform their responses to COVID-19, privacy experts and civil liberties campaigners have been increasingly voicing their concerns about the impacts of the use of such data on individual rights, while also querying the wider utility of some of this tracking.

Compared to using individualized location data for contact tracing, deriving public health insights from aggregated phone location data in theory poses fewer privacy risks. European telecoms companies remain adamant that the information is anonymised and aggregated and cannot be traced to any specific individual or phone.[111]

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[109] Gould, M, Joshi I and Tang, M (2020) The power of data in a pandemic. UK Government Blogs 28th March 2020 https://healthtech.blog.gov.uk/2020/03/28/the-power-of-data-in-a-pandemic/

[110] Lewis, P et al (2020) UK government using confidential patient data in coronavirus response, The Guardian, Sunday 12th April 2020 https://www.theguardian.com/world/2020/apr/12/uk-government-using-confidential-patient-data-in-coronavirus-response

[111] Espinosa, J and Fildes, N (2020) Tracking coronavirus: big data and the challenge to privacy. Financial Times April 8th 2020 https://www.ft.com/content/7cfad020-78c4-11ea-9840-1b8019d9a987

However, a 2019 study by researchers at Imperial College London and Belgium's Catholic University of Louvain revealed there is a way to re-identify 99.98% of individuals in location data using just 15 demographic characteristics. Their model suggests complex data sets of personal information cannot be protected against re-identification by the current methods of anonymising data that telecoms companies are using and are unlikely to satisfy the standards for anonymisation set forth by EU GDPR legislation. [112] There are several other studies which also highlight the relative ease with which data can be de-anoymised including one looking at credit card data which demonstrated that just four random pieces of information were enough to re-identify 90% of the shoppers as unique individuals. [113] Concerns around the weakness of some of the methods being used to anonymise data being used to model COVID-19 such as encryption methods have led commentators to call for the data to be continually assessed for the possibility of corruption for as long as the data is being used.[114]

Privacy commentators and civil liberties groups have raised concerns about whether the data will be repurposed for other means and for how long the EU intends to hold onto the data. Indeed the EDPS itself have pointed out that there is a tendency for these initiatives to become permanent following their introduction:

> *'The EDPS often stresses that such developments usually do not contain the possibility to step back when the emergency is gone. I would like to stress that such solution should be still recognised as extraordinary'*[115]

This has led to calls for a 'sunset clause' to be incorporated in the use of any data, similar to the one being called for with contact tracing apps. Commentators have also called for governments and the EU to provide clear and transparent assurances as to what the data that is being supplied by telecoms companies will be used for.[116]

Questions have also been raised about the appropriateness of partnerships between governments and big tech companies and how these partnerships will be regulated**.**[117]

[112]Rocher, L, Hendrick, JM, & De Montjoye, YA (2019) Estimating the success of re-identifications in incomplete datasets using generative models. Nat Commun 10, 3069 (2019). https://doi.org/10.1038/s41467-019-10933-3

[113]De Montjoye, YA et al (2015) Unique in the shopping mall: On the reidentifiability of credit card metadata Science 30 Jan 2015:Vol. 347, Issue 6221, pp. 536-539 https://science.sciencemag.org/content/347/6221/536.full

[114] Stupp, C (2020) Europe tracks residents phones for coronavirus research, Wall Street Journal, March 27th 2020 **LINK**

[115] Chee, FY (2020) Vodafone, Deutsche Telekom, 6 other telcos to help EU track virus. Reuters Website, March 25th 2020 https://www.reuters.com/article/us-health-coronavirus-telecoms-eu/vodafone-deutsche-telekom-6-other-telcos-to-help-eu-track-virus-idUSKBN21C36G

[116] Espinosa, J and Fildes, N (2020) Tracking coronavirus: big data and the challenge to privacy. Financial Times April 8th 2020 https://www.ft.com/content/7cfad020-78c4-11ea-9840-1b8019d9a987

[117] Roberts, S (2020) Tracking Covid-19 using big data and big tech: a digital Pandora's Box. London School of Economics Blog April 20th 2020 https://blogs.lse.ac.uk/politicsandpolicy/tracking-covid-19/

## 6.6 Limitations and biases inherent in big data

There are also some concerns regarding the limitations and biases presented by the use of this type of data. Smartphone ownership remains an indicator for relative wealth, even in regions like the United States where 80% of adults have a smartphone. People without smartphones tend to already be marginalised, so making inferences or developing policies based on aggregate location data can wind up disregarding the needs of those who don't appear in the data and who may be in most need of the services.[118]

Even among the people with smartphones, conclusions drawn from large scale data can overlook the needs of people in areas of disadvantage. For example, data showing that people in one region are traveling more than people in another region might not mean that these people are failing to take social distancing seriously. It could mean that they live in an underserved area and must thus travel longer distances for essential services like groceries and pharmacies. [119]

## 6.7 How will this type of data be used in post lockdown phase?

As the peak of infections has been reached, many countries are beginning to lift restrictions. Continued situational monitoring will be important as the COVID-19 pandemic is expected to come in waves. Mobility data will be important to understand how lifting and re-establishing various measures, depending on virus peaks, affect behaviours.[120] After the pandemic has subsided, mobile data will be helpful for post-hoc analysis of the impact of different interventions on the progression of the disease and cost-benefit analysis of mobility restrictions.[121]

# 7. Conclusion

New technologies and digital measures to combat COVID-19 have been introduced at rapid pace since the beginning of the pandemic. Governments and health authorities have been keen to harness the potential value of such measures including contact tracing apps and the analysis of big data to assess mobility patterns. The advantages of such measures are clear, contact tracing apps can automate a portion of manual tracing programmes which are labour intensive, reaching a greater number of people in a shorter timeframe than would be possible with a manual only system. The analysis of large datasets of mobile location data

[118] Hoffman-Andrews, J & Crocker, A (2020) How to Protect Privacy When Aggregating Location Data to Fight COVID-19. Electronic Frontier Foundation April 9th 2020 https://www.eff.org/deeplinks/2020/04/how-protect-privacy-when-aggregating-location-data-fight-covid-19

[119] Hoffman-Andrews, J & Crocker, A (2020) How to Protect Privacy When Aggregating Location Data to Fight COVID-19. Electronic Frontier Foundation April 9th 2020 https://www.eff.org/deeplinks/2020/04/how-protect-privacy-when-aggregating-location-data-fight-covid-19

[120] . https://advances.sciencemag.org/content/early/2020/04/27/sciadv.abc0764

[121] Oliver,N et.al (2020) Mobile phone data for informing public health actions across the COVID-19 pandemic life cycle, Sci. Adv10.1126/sciadv.abc0764 (2020) https://advances.sciencemag.org/content/early/2020/04/27/sciadv.abc0764

allows governments to assess detailed mobility patterns of its citizens at various stages of the pandemic to inform their public policies. However, the same digital solutions that offer advantages also present a number of challenges that must be overcome if they are to achieve their true potential.

The issue of privacy and individual user data security has been at the forefront of every discussion concerning the use of digital measures in the COVID-19 pandemic. While undoubtedly global health emergencies of this magnitude require that citizens afford some flexibility to their governments with regard to legislation and policy, data privacy is not something that individuals or civil liberties groups are willing to compromise on. With contact tracing apps, governments and health authorities have acknowledged that in order for them to be effective they need widespread acceptance and trust by the public. This will require complete transparency with regard to how citizen's data is being stored and used. With ongoing concerns and questions being raised by technical, privacy and data experts, there are question marks over whether any government has succeeded in this regard. Low adoption rates in apps currently being used in Norway, Australia and Singapore further indicate uneasiness concerning their use.

Tensions regarding the architecture being used to develop the apps has led to a fragmented landscape in Europe with countries including the UK and France holding out on using centralised apps while the majority move toward the decentralised google/apple approach. It remains to be seen how this will impact the re-opening of borders and whether interoperability of individual apps across borders is even technically possible regardless of whether there is consensus of the type of architecture being used.

Similarly, the use of aggregated anonymised mobile data to assess a population's mobility patterns at various stages of the pandemic can provide practical and useful insights for governments when deciding how best to allocate resources as well as removing and where necessary, re-introducing social distancing measures. In theory, as datasets are anonymised and aggregated they do not provide a threat to data privacy. However, several studies have indicated that there is potential to re-identify individuals in these datasets and that current annonymisation techniques are not sufficient to afford full privacy to the individual. The inherent biases and limitation of the data, including the potential to marginalise those who do not own smartphones from any analysis, in turn has implications for the accuracy of public policies.

There is no doubt that digital technologies offer opportunities to accelerate the ability of government and health authorities to respond to COVID-19. However these technologies also present significant ethical and technical challenges that will require a cohesive and robust response if governments are to harness the potential that these solutions offer.