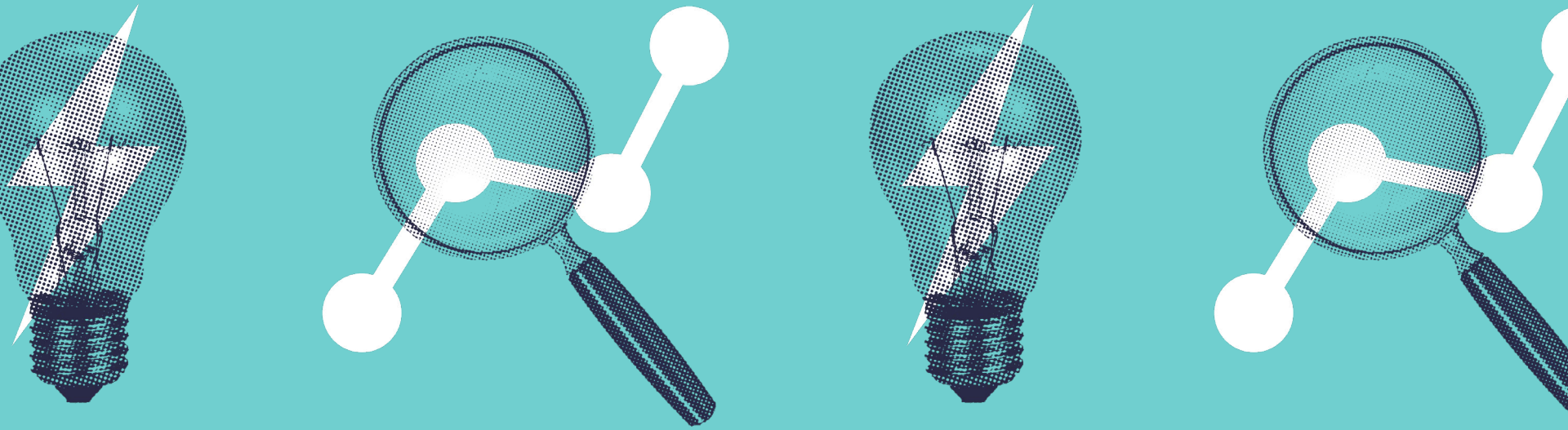
COVID-19 Repository & Public Attitudes

2020 in Review

Centre for Data Ethics and Innovation



About the CDEI

The Centre for Data Ethics and Innovation (CDEI) is an independent expert committee, led by a board of specialists, set up and tasked by the UK government to investigate and advise on how we maximise the benefits of data-driven technologies.

Our goal is to create the conditions in which ethical innovation can thrive: an environment in which the public are confident their values are reflected in the way data-driven technology is developed and deployed; where we can trust that decisions informed by algorithms are fair; and where risks posed by innovation are identified and addressed.

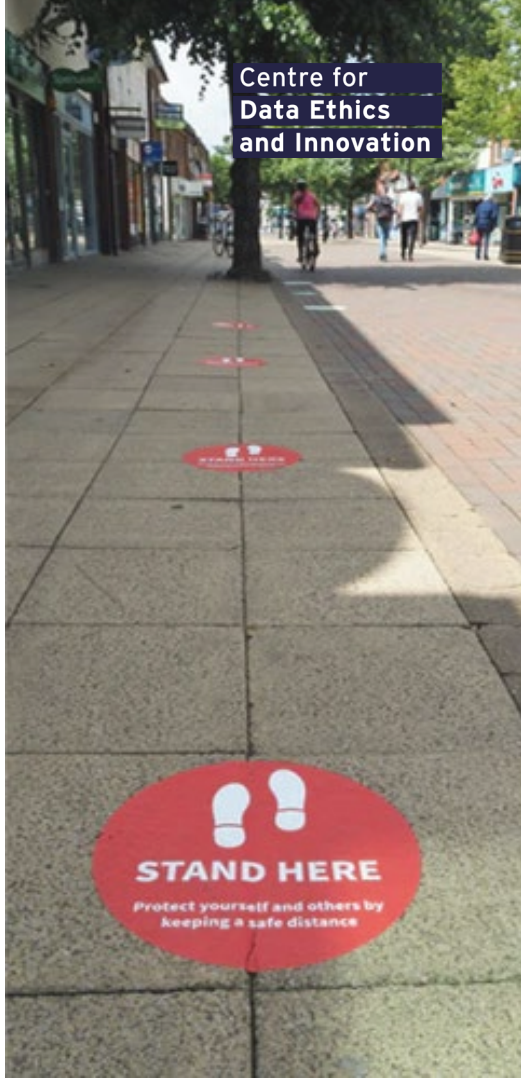
For more information about the COVID-19 repository, our Public Attitudes work, or the CDEI's work, please email c19-repository@dcms.gov.uk, public-attitudes@cdei.gov.uk or cdei@cdei.gov.uk.

Centre for Data Ethics and Innovation

Executive Summary: COVID-19 Repository

The COVID-19 pandemic has caused untold damage to our society. An unprecedented international effort has been required to stem its advance, with government, industry, and civil society marshalling all available resources to protect the most vulnerable, whilst searching for a long term solution to the crisis. **While the impact of the pandemic has been catastrophic, it could have been greater still were it not for the contributions of science and technology.** This includes data-driven technology, which encompasses artificial intelligence, traditional algorithmic systems, and tools and techniques from the discipline of data science.

Beginning in March 2020, the CDEI began to monitor examples of where this technology was being put to use, documenting them within a "COVID-19 repository". While public attention largely centred on high profile applications aimed at either suppressing the virus (e.g. contact tracing apps) or coping with its effects (e.g. an algorithm to determine qualifications in the absence of exams), **our research highlights the breadth of applications beyond these two use-cases.** From the piloting of drones that delivered medical supplies to remote regions, to the creation of health equipment databases that monitored the availability of assets in the NHS, the private and public sectors alike have tested a wide range of data-driven interventions in the last 12 months.



Executive Summary: COVID-19 Repository

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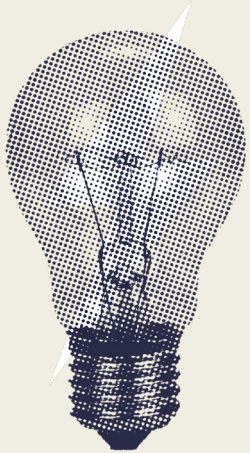


Data-driven technology has not only been used to combat the immediate public health crisis. It has also been **deployed to mitigate the wider effects of lockdown, not least to keep public services running**. Some of these data-driven innovations were to be expected. Indeed, in the early days of the pandemic many science and technology commentators predicted artificial intelligence would play a central role in the discovery of COVID-19 vaccines and treatments - forecasts that have lived up to reality.

Yet a closer look at the use-cases logged within **our repository reveals a number of unexpected trends and patterns.** One of these is that, aside from driving forward advances in vaccine research, artificial intelligence did not play the outsized role many thought it would in relief efforts. Instead, it has been conventional data analysis, underpinned by new data sharing agreements, that appear to have made the biggest difference to the work of health services and public authorities.

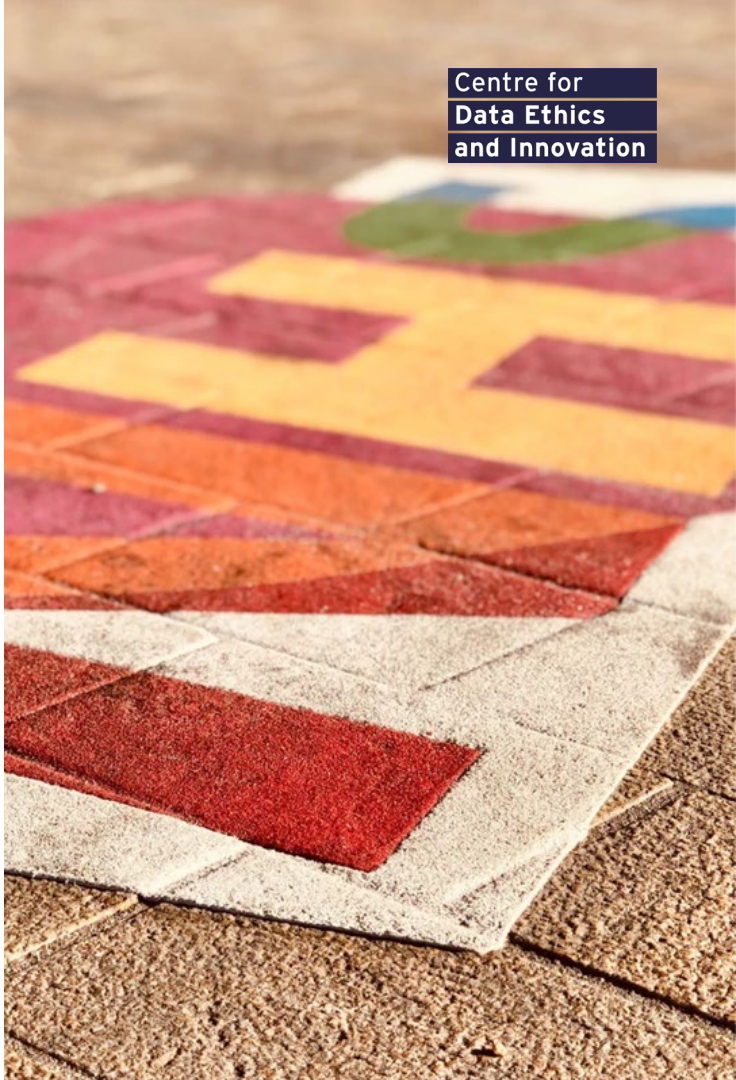
It will take time to properly evaluate the impact of the initiatives documented in this report, and as such we have deliberately chosen not to make an overall assessment of success or failure. Although we are highlighting positive aspects of the trends we have seen, that is not to say that there aren't lessons to be learnt. In the meantime, however, **we can at least take a temperature check of public opinion, and ask what society has made of the use of technology during the crisis**. Have they supported the innovations captured in our repository? Have they felt that technology has been used well and in a timely manner? Do they believe there has been sufficient oversight of its deployment?

Executive Summary: Public Attitudes

To help answer these questions, the CDEI commissioned Deltapoll to conduct a longitudinal survey of UK public opinion with a representative sample of over **12,000 individuals**, running from June to December 2020. The results suggest **significant public support for the use of data-driven technology** over that period. Almost three quarters (72%) of the UK population felt that digital technology had the potential to be used in response to the outbreak - a sentiment shared by all demographic groups.

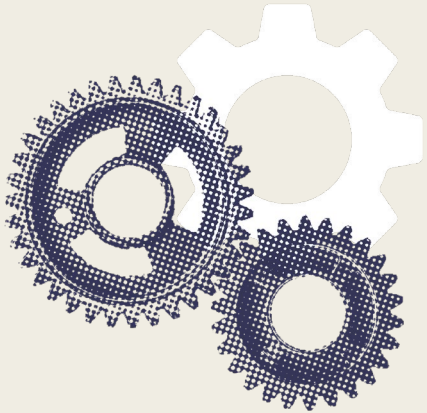
A majority of the public also showed support, in principle, for a number of specific use-cases. These were used to test public attitudes towards applied hypothetical real world examples of data-driven technology, as well as abstract statements. This includes technologies that have not been widely adopted, such as wearable technology to aid social distancing in the workplace.

However, many respondents also felt that the **potential of data-driven technology was not being fully realised**. Fewer than half (42%) said digital technology was making the situation in the UK better (although only 7% claimed it was making matters worse). This points to an **"opportunity gap"** - a chasm between technology's potential and the perceived reality of how it has been applied.



Executive Summary: Public Attitudes

Centre for Data Ethics and Innovation



What accounts for this shortfall? When asked the main reason why digital technology might not be effectively used in the COVID-19 response, a plurality of respondents cited concerns about whether people and organisations would be able to use the technology properly (39%). This was more than double the proportion of the public who pointed to problems with the technology itself (17%).

Some respondents also expressed **misgivings about the governance of data-driven interventions.** Whilst 43% of the public said existing rules and regulations were sufficient to ensure the technology is used responsibly, still close to a quarter (24%) disagreed.

These findings are underscored by a statistical analysis of the results. When controlling for all other variables, we found that **trust in the rules and regulations governing technology is the single biggest predictor of whether someone believes that digital technology has a role to play in the COVID-19 response**. This trust in governance was substantially more predictive than attitudinal variables such as people's level of concern about the pandemic, or belief that the technology would be effective; and demographic variables such as age and education.

Executive Summary: What's Next

The overall picture presented by our polling is one of a public that is largely sympathetic, and in some cases enthusiastic, about the idea of AI and data being used to tackle the pandemic. But that this has been in spite of, rather than because of, the way the technology has been deployed in different contexts. This suggests that **public support is tenuous and dependent on trust in the governance of technology**.

Trustworthy governance will enable the UK to make better use of data-driven technology and close this opportunity gap.

For organisations and policymakers looking to realise the benefits of greater data use, it will be important to build data governance mechanisms that are capable of building long term trust, and the CDEI is committed to playing its part.

Executive Summary: What's Next

Centre for Data Ethics and Innovation

The CDEI's Trust Matrix provides a framework for helping organisations build trustworthy governance. Continued public engagement can help us to understand what 'good' looks like for each of these principles, across different applications and use cases:

- **Accountability:** There needs to be a reliable and understandable decision-making process for the public to understand who is responsible for decisions about data use.
- **Transparency**: Organisations that build and use the technology need to be clear about where it has been deployed, the terms under which it has been used, and the trade-offs involved in its use. This allows for greater public and media scrutiny, and enables people to make reasoned judgements about the merits of the different data-driven interventions with the full facts available.
- **Value:** Data use should provide a benefit to individuals or society that is measured and evidenced. To build trust, public authorities and industry should communicate this impact, highlighting where the use of data-driven technology has had beneficial impacts.
- **Security:** Data should be secure, minimised and de-identified as much as possible, so the public feel sure that their individual privacy is protected from misuse.
- **Control:** Data-driven technologies which enable individuals to make better choices, become more informed or increase convenience, are more likely to command trust than uses where the benefits are less evident to citizens.

COVID-19 Repository

Summary of Findings

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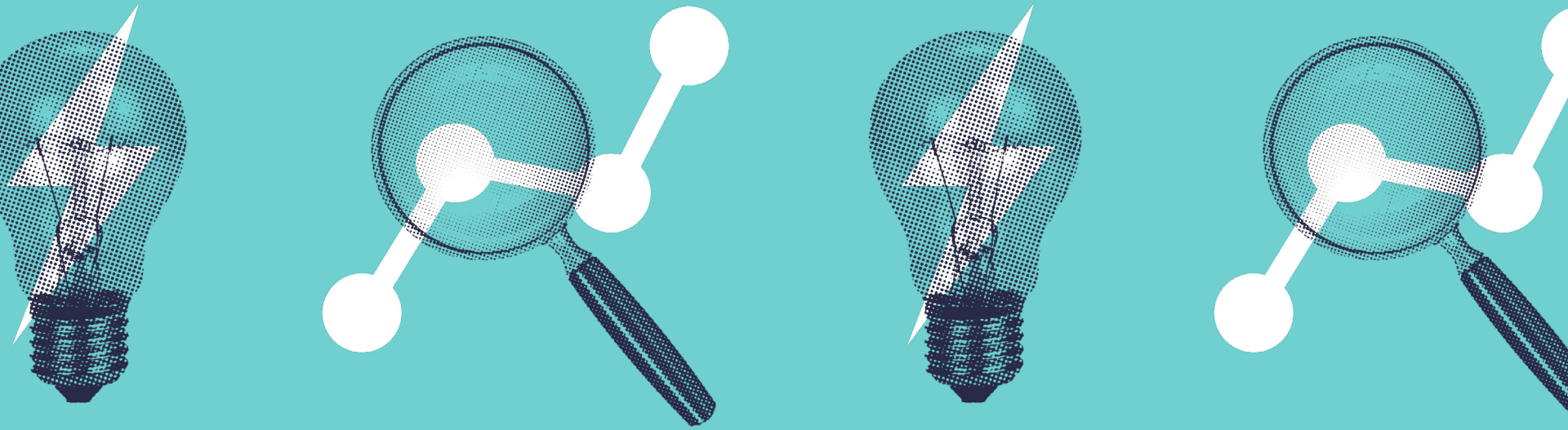

Findings Overview

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One of the core building blocks of the CDEI's COVID-19 response has been **our repository - a database for novel use-cases of data and artificial intelligence (AI)** specifically being used to counter and mitigate the effects of COVID-19.

Technologies and practices that we've considered include those that involve the use and collection of data, the combination of disparate data sources to create novel data products, the use of built-for-purpose big data tools to drive decisions, and machine learning (ML)/other forms of AI.

The repository aims to **highlight innovations that are yet to be fully explored**, encouraging researchers, the media and policymakers to widen the scope of their analysis and pay attention to lesser known use-cases.

This six-month retrospective details what we have learnt from producing the COVID-19 repository and the **10 key themes** that have emerged.

10 Key Themes

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1. Conventional data analysis has been at the heart of the COVID-19 response, not AI
2. Existing datasets provided the basis for much of the pandemic response
3. New methods of data storage were implemented to enable data sharing
4. In the face of a public health crisis, community data sharing increased
5. Local governments increasingly realised the importance and value of data
6. Where AI is prevalent, it is often being used in a healthcare setting
7. Many existing tools have been repurposed to solve COVID-19 related problems
8. Data-driven tools are also being used to measure and understand the effects of new rules
9. The focus is beginning to shift towards building future resilience
10. Data sharing across borders facilitated the discovery of new vaccines and treatments

Findings Overview

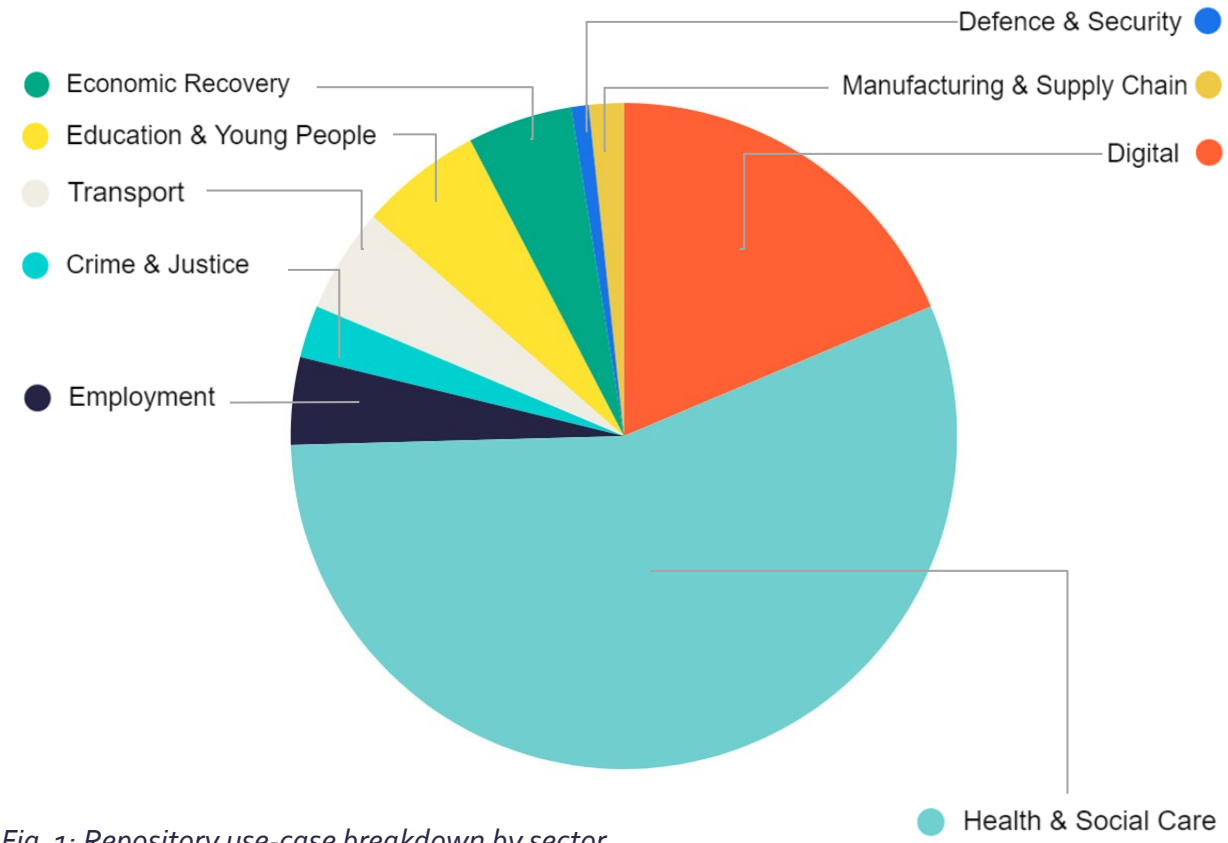

Fig. 1: Repository use-case breakdown by sector

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The COVID-19 repository was routinely monitored and updated between the months of from April 2020. In total, it comprises **118 individual use-cases,** which span a broad array of locations and sectors.

As shown in the chart opposite, the **majority of entries relate to the health and social care sector**. Given that the UK faces an ongoing public health crisis and is experiencing a third-wave of coronavirus infections, it is not surprising that these use-cases were most prevalent throughout 2020.

Findings Overview

Data-driven technology and AI has been used for a multitude of purposes in the fight against the virus. From connecting volunteers on social media platforms, to identifying treatments and vaccinations for COVID-19, **almost every facet of the response has required the support of data**.

Each entry in the repository was tagged with a 'primary purpose' (as per the key opposite). Use-cases were spread relatively evenly over the three categories, with a slightly higher proportion targeted at **supporting the public health response and mitigating the effects of lockdown**.

These final percentages **mask the trends over time**. As expected, we initially saw a concentration of entries focused on managing the immediate public health crisis, and as time moved on, we saw use-cases aimed at building future resilience and aiding the recovery.

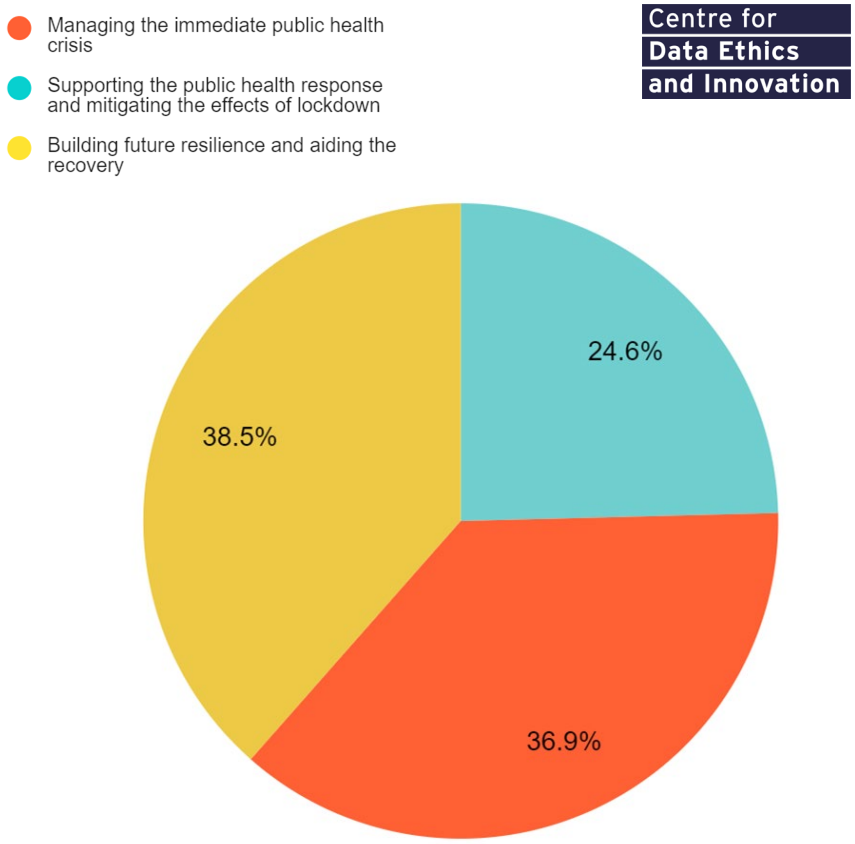

Fig. 2: Repository use-cases by primary purpose

COVID-19 Repository

Themes in Detail

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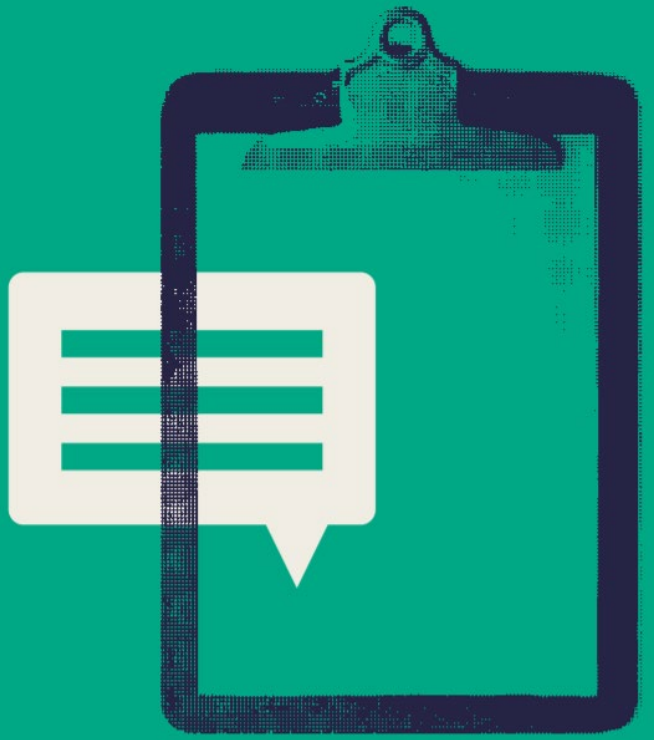

Theme 1

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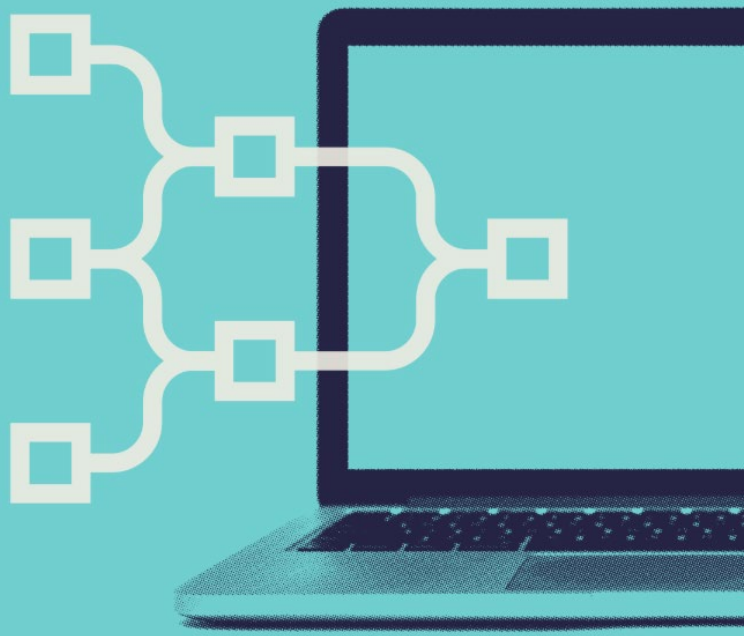
Conventional data analysis has been at the heart of the COVID-19 response, not AI



Theme 1

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Data has been at the heart of the COVID-19 response. The daily download of figures at the No.10 coronavirus briefings promptly **set the stage for data to play a central role** in tackling the challenges of the pandemic.

Primarily, data has been used as a starting point for government analysis and has helped to give the public a sense of the scale and spread of the virus. Although the collection and reporting of data has not been without its deficiencies, **data has managed to provide some grounding of thought in a time of extreme uncertainty.**

Data use has not just been limited to tracking infection and death rates. In addition, we have seen the use of geolocation and telecoms data to monitor population movements, and the use of hospital asset data to see where equipment was free and where it was needed. Without access to data, decision-makers would have been less well equipped to target resources and interventions to those who needed them most.

In contrast, **AI and machine learning take-up was minimal.** While the repository did capture some use-cases where AI was being deployed, we did not see evidence of widespread adoption and use-cases were mostly clustered in the healthcare setting. However, AI has been central to the discovery of new vaccines, which is extremely significant (see p.45). A potential explanation behind lower levels of adoption more widely lies in the lack of access to training data: COVID-19 being such a new phenomenon that the data required to train algorithms did not yet exist.

Theme 1: Repository Examples

Data has been used in a plethora of contexts and ways throughout the pandemic, and we will unpick these further in the slides that follow. Below are just a few examples of tools and procedures that have been implemented:

- **The ONS and its Data Science Campus explored the impact of COVID-19 on UK society and the economy** by looking at new data sources to strengthen the information held through surveys and other sources. The aim was to provide government with timely indicators of the impact of social distancing, the number of people in self-isolation, changes to trade in goods and the effect on businesses. To inform the public more broadly, they published weekly articles and statistical bulletins on the impact of COVID-19.

- **The government commissioned NHS England, NHS Improvement and NHSX to develop a** [data platform] that would provide those national organisations responsible for coordinating the response with secure, reliable, and timely data, in order to make informed and effective decisions.

- **The Greater London Authority (GLA) created a COVID-19 API to ensure that data on COVID-19 was consistent.** Due to the regular changes that were being made when initially reporting COVID-19 cases at the start of the pandemic, City Hall set out to download, check, clean, and establish a consistent time series for the public and others to use, resulting in an API and interactive London dashboard on cases and hospital treatments. One of the successes of this release was that it bought together data from different sources to tell a clearer story of what was happening across London.

Theme 2

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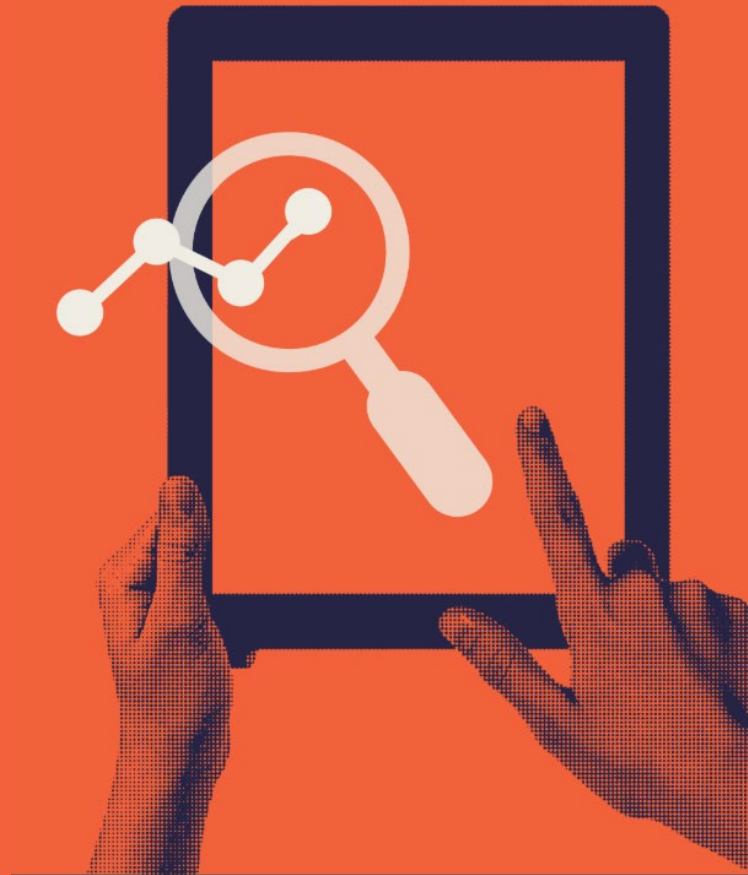
Existing datasets provided the basis for much of the pandemic response



Theme 2

With data being at the heart of the pandemic response, it was crucial that organisations first looked inwards and analysed their existing datasets, to determine their utility in the context of COVID-19.

Many found that additional data collection was not immediately necessary. Instead, **augmenting and repurposing existing data for the specific COVID-19 circumstances** could provide the basis for an effective response to the emerging challenges of the pandemic.

While this in and of itself does not constitute innovative use of data, it has played, and continues to play, an extremely important role in the public health crisis.

Many such datasets are operating under an enhanced model to cope with the additional demands of the pandemic. This may involve the **exploration of data linkages or simply making existing data publicly available.**

Theme 2: Repository Examples

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- **A variety of organisations have made population and patient-level data publicly available to aid COVID-19 research and decision-making.** Google have been hosting public datasets on the disease and other useful information such as OpenStreetMap data, and have made it free to query through a COVID-19 Public Dataset Program. Some clinicians are also sharing anonymised patient registries, detailing how patients have responded to COVID-19 treatments, thereby helping researchers and doctors understand how efforts to treat the disease are developing.

- **A large number of public bodies in the UK, coordinated by MHCLG, took part in the Shielding Programme,** where data was used to identify people vulnerable to COVID-19. The bodies then worked with partners across the UK economy to offer those vulnerable people priority access to services, improving their ability to isolate.

- **Several major tech platforms including Google, Apple, and Facebook have been publishing "mobility reports" containing aggregated location data.** These have helped public officials understand how busy certain types of places are, and have informed public health interventions. Mobile network O2 worked with Imperial College on a similar basis, using aggregated anonymised data only.

Theme 3

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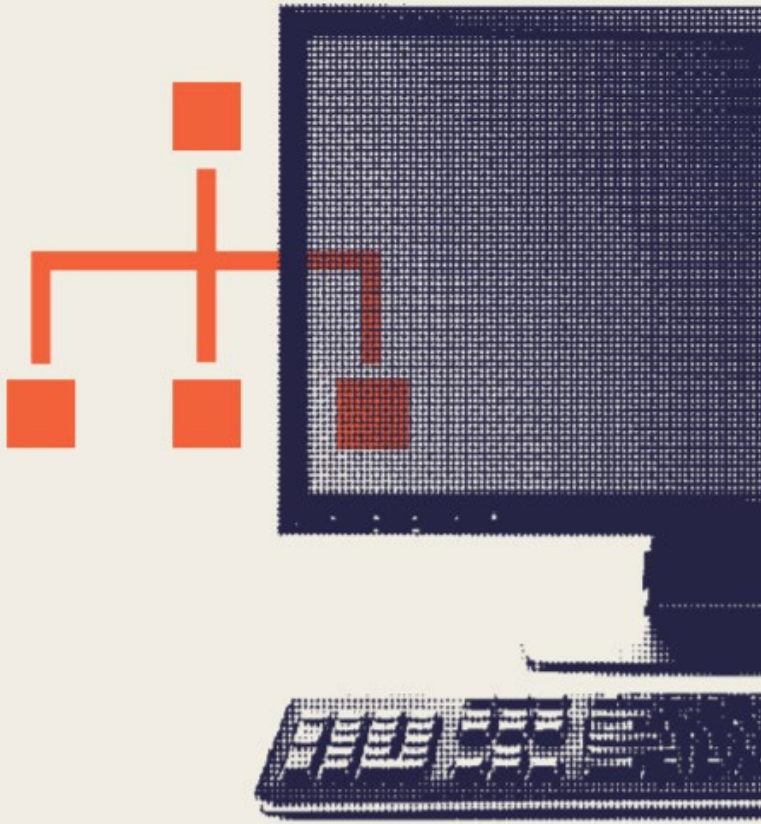
New methods of data storage were implemented to enable data sharing



Theme 3

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Organisations across the public and private sectors have long shared data to improve their understanding of issues and make better decisions. The challenges presented by the pandemic have only increased the need for such practices, with **authorities urgently seeking access to data to help keep people safe** and public services running.

New data sharing efforts have taken a variety of forms. In some cases, the government and public services have **opened up datasets to the private sector for the first time** (for example, by giving supermarkets access to information about vulnerable patients most in need of assistance). In other instances, we have seen **individual public services pool their datasets**, allowing for more sophisticated data analysis. This includes some children's services providers in London, which chose to collect and combine data on service performance in order to identify early signs of system stress.

While seemingly straightforward to administer, these data sharing initiatives **required new legal agreements, oversight measures, technical standards and data storage tools** - most of which had to be established in a matter of weeks of the first UK lockdown.

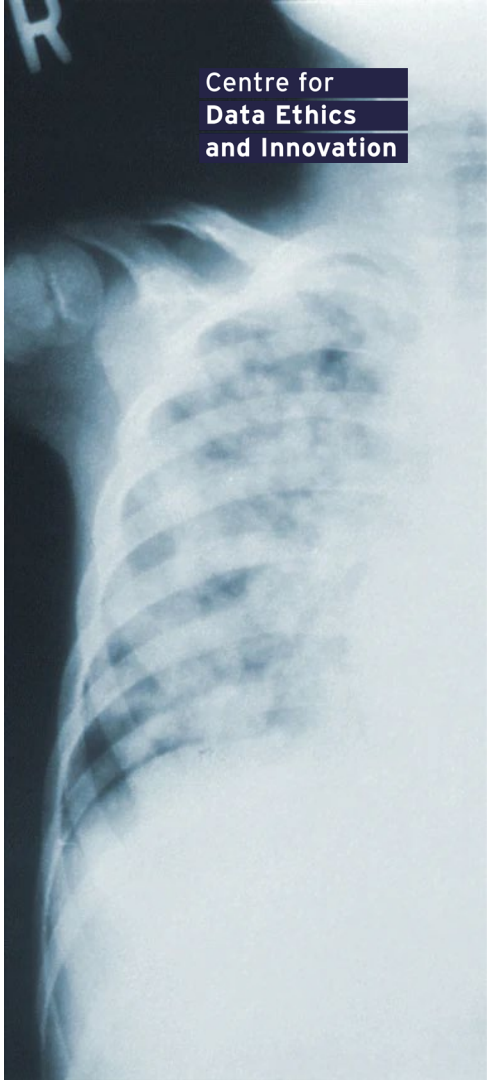
Data storage and data sharing throughout the pandemic has, of course, not been without its challenges. Even though we have seen many positive examples of these practices, there are still lessons to be learnt, and many barriers to the more effective use of data continue to endure.

Theme 3: Repository Examples

- **The creation of a national COVID-19 chest imaging database (NCCID)** - a centralised UK database containing X-Ray, CT and MRI images from hospital patients across the country, to support a better understanding of the COVID-19 virus, and to develop technology which enables the best care for patients hospitalised with a severe infection. It is a joint initiative established by the NHSX AI Lab, the British Society of Thoracic Imaging (BSTI), Royal Surrey NHS Foundation Trust and Faculty.

- **Several local authorities collected data from children's services providers to understand the challenges they faced during the COVID-19 outbreak.** The Commissioning Alliance (including 15 London-based local authorities and the Home Counties) developed one such initiative in the form of a COVID-19 Situational Reporting Tool. The tool aimed to collect data in a more efficient and streamlined way, with a view to supporting local authorities to provide ongoing support to care and education providers during the pandemic. Providers were asked to complete a short survey on a weekly basis, with questions designed to identify those providers experiencing specific issues/risks or who were in need of support. The survey also provided some high-level information about the number of young people and staff who contracted COVID-19.

- **A central data hub for social care providers that collects data on how social care providers are coping** with the challenges posed by COVID-19 (including confirmed cases of COVID-19 and deaths), which is shared with the Adult Social Care Board. In sharing this information the hub aims to enable faster responses alongside public health partners.



Theme 4

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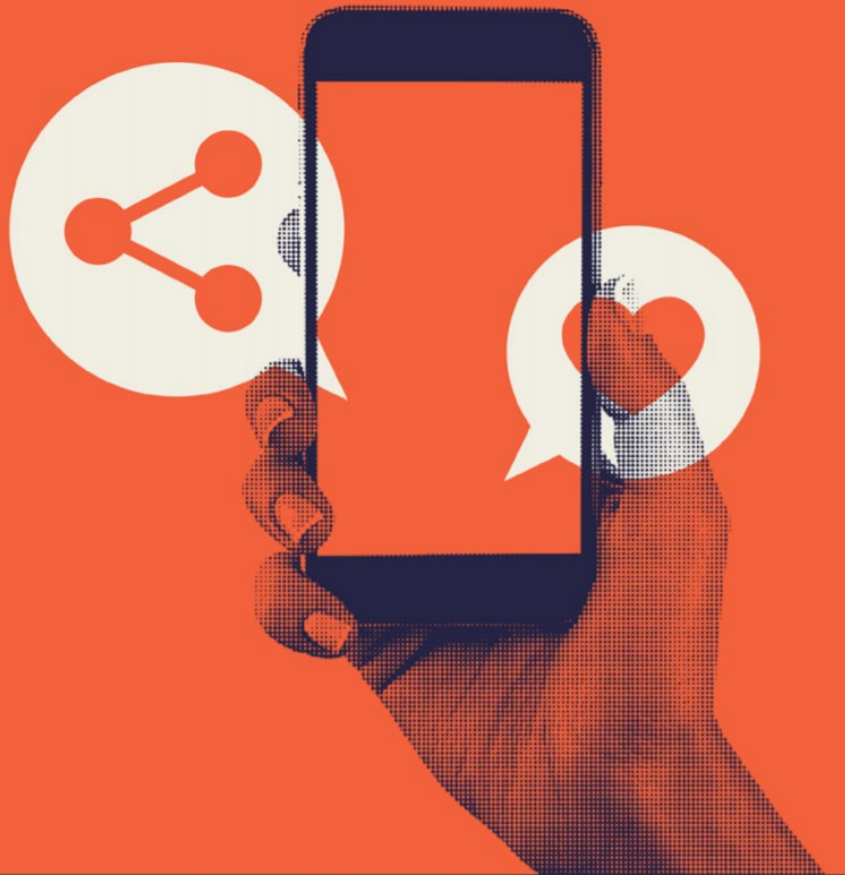
In the face of a public health crisis, community data sharing increased



Theme 4

In the face of the public health crisis, we have seen the UK pull together with a renewed sense of community and empathy for those hardest hit by the virus. This outpouring of support has helped to propel several new **community data sharing initiatives**, where individuals and organisations have shared data for the benefit of the wider population. Use-cases have encompassed everything **from small local schemes to widespread global initiatives**, and involved the implementation of a variety of methodologies, including open source databases and community mapping tools.

Many of the community data sharing use-cases have pertained to supporting the immediate health response, for example Public Health England's FluSurvey initiative, which has collected data on COVID-19 symptoms from thousands of participants. Aside from proactively volunteering their own data, it appears that **a large proportion of the public are generally supportive of health and care data being shared during the crisis**. According to the National Data Guardian, 78% agreed that "during a public emergency, such as COVID-19, it is more important than usual that health and care data is shared with all those involved in the emergency response".

Theme 4: Repository Examples

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- **The use of self-reported health data to track and understand COVID-19 symptoms - FluSurvey** is a web tool (managed and monitored by Public Health England) designed to monitor trends of infectious diseases. Any UK citizen can register on the platform to report symptoms and the data is then analysed to provide insights on community transmission, exposure risk, changes in healthcare-seeking behaviour and adherence to recommendations. **The COVID Symptom Study** - a collaboration between King's College London, Guy's and St Thomas' Hospitals, and ZOE Global Limited - is a not-for-profit initiative that was launched at the end of March 2020 to support COVID-19 research. With over 4 million contributors globally, the Study is the world's largest ongoing study of COVID-19 and is led by ZOE Co-Founder, Tim Spector.

- **The Oxford Martin Programme on Pandemic Genomics initiated and co-leads the Open COVID-19 Data Working Group**, which has created an open-access database to track the coronavirus on a case-by-case basis, forming the underpinning data for the COVID-19 HealthMap. This may be the single most accurate portrait of the virus' spread through the human population.

- **Glasgow City Council have established an online platform that allows residents to share suggestions for creating safer spaces for walking and cycling as COVID-19 restrictions are eased.** The Commonplace Mapping Tool allows users to highlight pinch points across the city centre and in different neighbourhoods, where emergency temporary measures such as pavement widening and new cycle lanes could be introduced to help people maintain physical distancing.

Theme 5

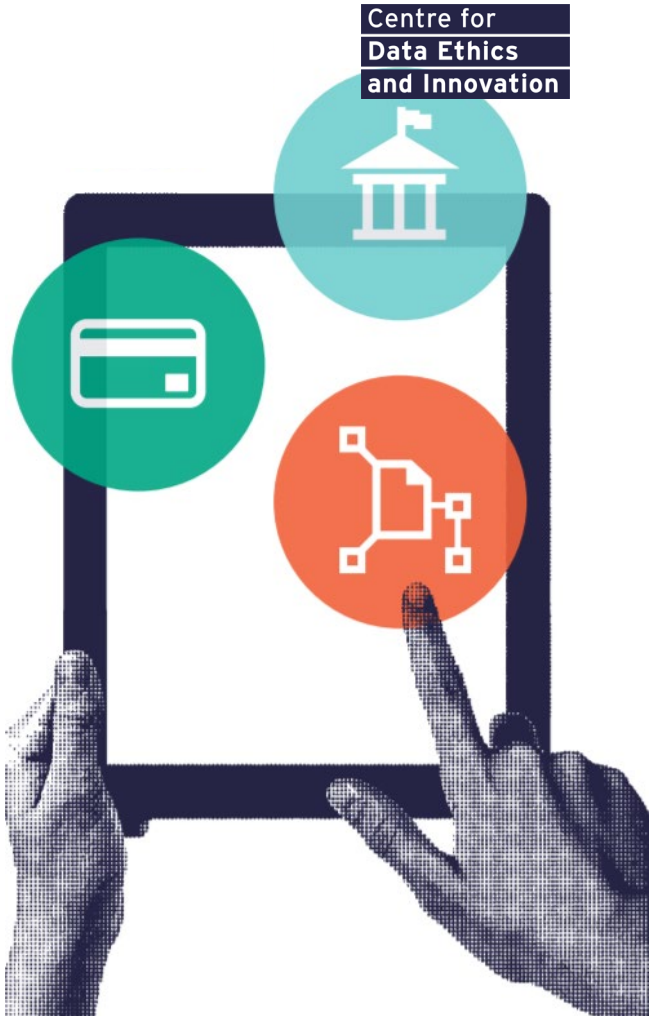
Centre for Data Ethics and Innovation

Local governments increasingly realised the importance and value of data

Theme 5

While local authorities are rarely seen as pioneers in technological innovation, the pandemic has required them to experiment with **new ways of using data in order to keep their residents safe, support local businesses and find new ways of delivering services** at a distance. In August 2020 the CDEI began capturing examples of how local government was using data and data-driven technology in novel ways, including to identify vulnerable residents and monitor demands on local agencies, for example children's services. Local authorities have also been given access to valuable datasets for the first time, such as the Shielded Patients list.

However, separate research from the CDEI suggests that the **progress made across local government in the last year may not be sustained without concerted effort and support**. Conversations with local authority data leads reaffirmed a number of deep-seated barriers to innovation, including confusion over what is permissible under the law, as well as shortfalls in funding and difficulty in finding staff with the necessary digital skills. For more information on the local government pandemic response please see our recent publication.



Theme 5: Repository Examples

- **Identifying those most clinically and economically vulnerable to COVID-19 -** Hackney Council used unique property reference numbers (UPRNs) to combine a number of internal and external datasets for the first time. This enabled them to identify residents most in need of support, including older residents and people with disabilities living alone. (See Case Study on p.30)

- **The Trafford Data Lab** at Trafford Council developed a suite of web applications last year that use data from the government's COVID-19 dashboard. Links to the apps are available on their COVID-19 resources page, and were developed using the R open source programming language so that they can be repurposed and scaled-up to other local authorities. The source code is available in the relevant GitHub repositories, and the apps are used by Trafford Council's Public Health team, residents of Trafford, and other local authorities.

- **Informing direct public health responses to COVID-19 outbreaks** - The NHS Test and Trace programme has involved close collaboration between local and central government. Local authorities have used the postcode level data collected by this programme to target their resources and messaging at specific neighbourhoods.

Case Study: Hackney Council

Hackney

Centre for Data Ethics and Innovation

In March 2020, Hackney Council published a briefing deck which detailed how they were using data to undertake their COVID-19 analysis. The council's aim was to understand the scale of the problem and identify residents most vulnerable to the effects of COVID-19.

Methodology: to build a live view of the most vulnerable residents in Hackney, the Council joined together several datasets at a property level, using the Unique Property Reference Number (UPRN) from their master address database (the LLPG). These so far include:

- **Council data**: Housing Benefit; Council Tax; Hackney Homes; Electoral Register; BRE report; Local Land and Property Gazetteer; Adult Social Care; Children's & Families Services; and assisted bulky waste collections.

- **External data:** Land Registry price paid; Energy Performance Certificates; and Tenancy Deposits.

The Council has announced plans to add the following data: parking data; tenancy sustainment data; Free School Meals; and people living in temporary accommodation with an underlying health condition.

The deck contained a visualisation of the dataset, which provided a guide for other local authorities and a basis for them to build upon, as seen below. Built within Qlik, each row refers to a single residential property within Hackney, identified by its UPRN. Multiple columns build up a picture of each property.

COLUMNS

ROWS

Name	UPRN	Address	Known to social care	Receiving HB/CTS	Only 1 adult in the hh
Example	100012345678	22 Example Rd	Y	N	Y
Example 2	100087654321	13 Example St	N	Y	Y

Hackney Council acknowledged several limitations to their exercise:

- Data quality may vary across systems and they're continuing to expand the data included, so figures are subject to change.

- Data is joined on the Unique Property Reference Number (UPRN), so there is risk of misjoining households if data is not up to date on systems.

- Data is for properties within Hackney, so Hackney residents currently living out-of-borough (for example, in temporary accommodation provided by Hackney) are not included.

Theme 6

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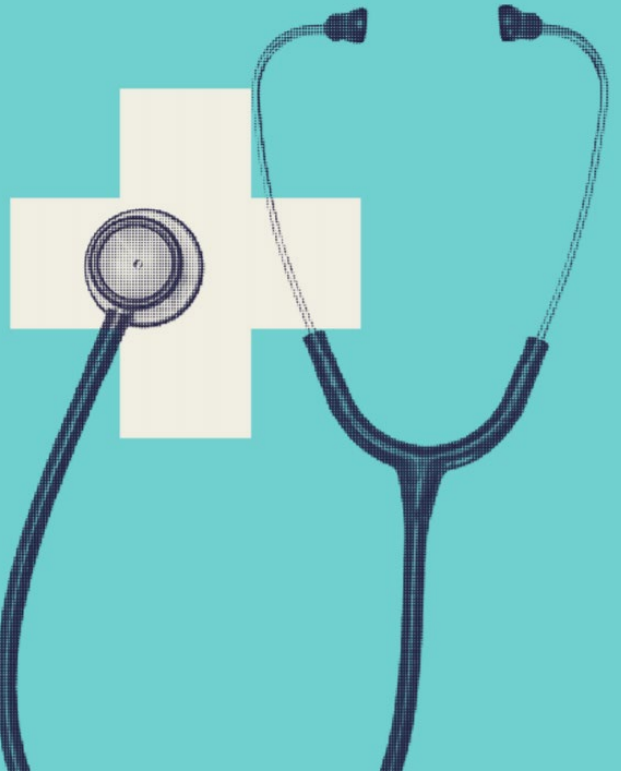
Where AI is prevalent, it is often being used in a healthcare setting



Theme 6

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While much of the innovation seen during the pandemic involved traditional methods of data collection and analysis, some public services and authorities did draw on more sophisticated techniques including **artificial intelligence to support their efforts.** Unsurprisingly these deployments were more common in the healthcare setting, where the unprecedented nature of the crisis has required public services to consider all available technologies, including those still nascent.

The **range of AI and ML being used across the sector was extensive**, from natural language processing being used for chatbots to keep hospital staff up-to-date with the latest policies and guidance, to AI-driven models for rapid virus detection.

While many of these systems were purpose built to address the unique challenges posed by the pandemic, we also saw **existing systems being brought from the margins to the mainstream**. One reason for fast tracking the adoption of such technologies was the need to manage the growing backlog of patients, caused by routine appointments and procedures being cancelled.

Theme 6: Repository Examples

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- **In a project at Oxford University Hospitals, researchers built an AI-driven test to screen patients for COVID-19** as they arrived at emergency departments. The test was able to predict whether a patient had coronavirus within an hour of their arrival, allowing for more rapid triaging away from non-COVID patients. (See Case Study on p.34). More recently, Excalibur Healthcare Services and Sensyne Health have partnered on an ultra-sensitive AI-driven lateral flow test that can detect the COVID-19 virus in the body within 10 minutes.

- **DeepMind applied its AlphaFold model to predict the structure of several under-studied proteins associated with COVID-19** - a process that is very computationally expensive without AI. These findings were shared with the wider scientific community to help contribute to its interrogation of how the virus functions.

- **UK firm Skin Analytics has developed cutting edge AI algorithms that can help identify skin cancer.** In 2020, working with their partners University Hospitals Birmingham NHS Foundation Trust (UHB), they piloted a new skin cancer triage service to safely reduce delays in skin cancer detection and treatment during the pandemic.

Case Study: AI-Driven Testing

Oxford University Hospitals NHS Foundation Trust

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In a project at Oxford University Hospitals NHS Foundation Trust (OUH), researchers built an AI-driven test to screen patients for COVID-19, in the first hour of them arriving at an emergency department. The test was trialled and studied as a collaboration between OUH and Oxford University, with ethical approval from the HRA (the central NHS authority).

In the pilot, the AI-driven testing tool was shown to be over 92% accurate and considerably faster than swab testing, which also requires the use of an expensive PCR machine, trained laboratory staff, and chemicals in high global demand - not all of which are available to every hospital.

The AI model (CURIAL) was trained using laboratory bloods, blood gases, and observations recorded routinely during 115,000 presentations to Oxfordshire's Emergency Departments, and looks for a 'biochemical and physiological signature' of COVID-19.

The researchers performed analyses during the validation study to investigate whether the algorithm showed ethnic, gender, or age bias. The analysis showed that rates of misclassification were not higher in BAME vs. White British patients, female vs. male patients, or over-60s vs. under-60s.

Current Work:

- In a translational study, the team have deployed advanced point-of-care blood analysers in the John Radcliffe Hospital's Emergency Department, allowing clinicians to get the required blood test results in only 10 minutes, vs. the 1hr required for lab bloods. Results from the new analysers feed in to a 'slimmed-down' CURIAL model (CURIAL-Rapide), allowing COVID-19 to be excluded at high-confidence in just 10 minutes. Access to quicker blood test results also benefits non COVID-19 patients.
- Supported by an award from the Wellcome Trust, a web interface has been developed that allows clinicians and bed-managers to use the model as a decision-support tool, enabling them to see for themselves which patients are deemed at very low risk of testing positive for COVID-19. The team have received the relevant approvals to deploy the interface tool at OUH for clinical pilot.
- The researchers are collaborating with University Hospitals Birmingham NHS Foundation Trust & Portsmouth University Hospitals NHS Trust to enhance model performance and externally validate CURIAL & CURIAL-Rapide.

For more technical details, please see this article in Lancet Digital Health, or contact andrew.soltan@medsci.ox.ac.uk. Research and academic access to the model is available online.

Theme 7

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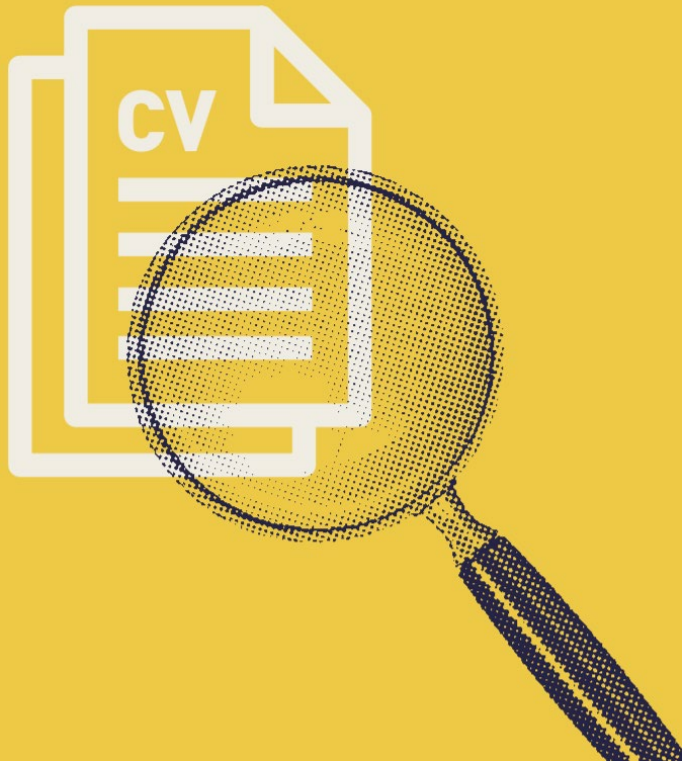
Many existing tools have been repurposed to solve COVID-19 related problems



Theme 7

In a similar vein to our second theme that saw a number of existing datasets forming the basis of the immediate response to COVID-19, **many existing technologies and AI applications were pivoted** to be used to mitigate the effects of the pandemic.

This kind of innovation is something that we saw within all sectors, and for all purposes - from deploying existing modelling techniques that could predict how infection rates would change over time, to piloting the use of drones to deliver vital medical supplies to remote locations. These examples **demonstrate the importance of data-based innovation being present throughout the economy,** which allowed for a more rapid response to the crisis than may have otherwise been possible.

This trend wasn't confined to organisations solving problems within their own sectors; it was also **seen *across* sectors, as different disciplines were able to support each other** with novel applications of their existing tools in a new field.

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Theme 7: Repository Examples

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- **The Royal Society's Rapid Assistance in Modelling the Pandemic (RAMP) initiative** brought together experts in data modelling from a diverse range of disciplines to model the pandemic and help policymakers anticipate how it might evolve over time. RAMP has established new research projects on topics such as urban analytics, aerosol transmission and human dynamics in small spaces; and it also enabled rapid review of modelling outputs. Among the volunteer modelling groups were staff from gaming company Improbable.

- **Online platforms, including Facebook, increased their use of automated content moderation (ACM) systems**. Uses for ACM included labelling the extremely high volumes of posts that included the word COVID in order to redirect users to factual information on the topic, and increased use of AI to detect extreme content, including that related to terrorism and suicide, allowing it to be prioritised for human review.

- **University Hospital of Morecambe Bay NHS FT** trialled the mixed reality headset, HoloLens 2, on a respiratory ward during the pandemic. The technology offers the capability to minimise face-to-face contact with patients who have symptoms of coronavirus whilst ensuring they receive immediate access to specialist opinion.

- **In a trial backed by the UK Space Agency, hospitals in Mid and South East Essex NHS Foundation Trust piloted a healthcare drone to transport medical supplies.** The aim was to avoid courier call-out waiting times, free up staff, reduce unnecessary physical contact and minimise the risk of secondary transmission of the virus.

Theme 8

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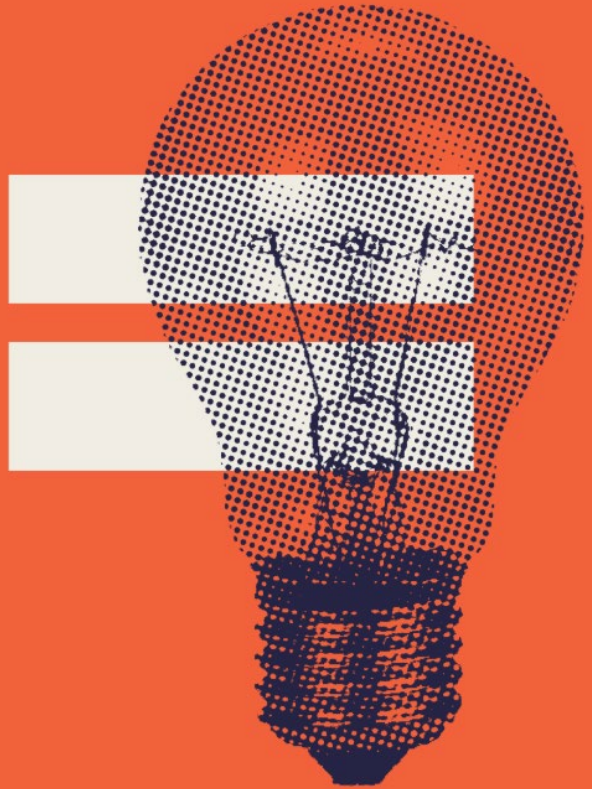
Data-driven tools are also being used to measure the effects of new rules



Theme 8

The introduction of social distancing measures in the early part of 2020 led to a profound shift in human behaviour, creating a new set of norms that had to be promoted, enforced and monitored.

AI and data-driven technology played an important role in meeting these objectives. Some employers, for example, experimented with wearables to notify their staff when they were in close proximity to others. Elsewhere, **pedestrian behaviours and flows in towns and cities were measured** to help local authorities understand 'pinch point' locations that required attention.

In some cases, live data was made available to the public to help them plan journeys and maximise safety. Researchers were also able to use this technology to **monitor how social distancing measures were changing human behaviour**, drawing on a combination of traffic flow, air quality and energy consumption data.

Moving forwards, these tools and the data that they provide will give authorities a clearer **sense of whether current social distancing measures are working**, and whether more guidance or enforcement may be required. They will also give authorities the information they need to make necessary changes to infrastructure and transport.

Theme 8: Repository Examples

Centre for Data Ethics and Innovation

- **Humanising Autonomy's behaviour video analytics software can measure and report whether social distancing measures are working**. Analysis of video footage from existing CCTV infrastructure, station cameras, and vehicles helps study the behaviours of transport users and create a historical analysis to identify behaviour changes over time. (See Case Study on p.41).

- **A number of companies have created wearables for automating social distance control in the workplace**. This has been in the form of both pivots of existing wearable technologies (e.g. Samsung have added social distancing management and monitoring features to their existing solutions), as well as novel wearables produced specifically for this application (British company Tharsus has designed an original system, Bump).

- **Newcastle University's Urban Observatory are using their smart city technology to understand the effects** of measures introduced in response to COVID-19. This includes pedestrian behaviour and flows, traffic, air quality, and energy consumption.

- **The Alan Turing Institute and researchers from the University of Warwick, UCL and University of Cambridge, are collaborating on Project Odysseus**, which aims to bring together multiple large-scale and heterogeneous datasets capturing mobility, transportation, and traffic activity over the city of London to help the London authorities understand the extent to which people are staying at home, i.e. the effectiveness of the current government approach.

Case Study: Humanising Autonomy and TfGM

HUMANISING AUTONOMY

Transport for Greater Manchester

Centre for Data Ethics and Innovation

In March 2020, Humanising Autonomy, a behaviour AI platform developer, partnered with Transport for Greater Manchester (TfGM) to improve the safety of passengers and staff at critical public transport interchanges. The project was funded by Innovate UK as part of an SBRI competition, 'Business-Led Innovation in Response to Global Disruption'.

Humanising Autonomy's behavioural AI platform provided insights from video footage from existing CCTV infrastructure at Bolton and Wythenshawe interchanges and Wigan bus station. This allowed the behaviours of pedestrians and transport users across three of the busiest interchanges in Greater Manchester to be studied.

Pre-existing, anonymised, GDPR-compliant CCTV footage was overlaid with Humanising Autonomy's explainable AI software in order to provide behavioural insights and temporal analysis. These insights helped the facilities' management teams at the interchanges to understand the implications of social distancing, including assessments of how passenger behaviour was affected by the pandemic (e.g. whether the busiest hours of an interchange differed), and an understanding of how infrastructure was being used given new requirements.

Through the insights gathered on pedestrian and passenger behaviour, TfGM were able to understand situations where social distancing adherence was challenging, and thus was able to respond intelligently to the new complications brought about by COVID-19, whilst respecting passengers' privacy.

In the longer term, analysis of the data collected can be used to intelligently implement changes to the TfGM infrastructure in order to assist a faster recovery from the COVID-19 pandemic with a "safer, more efficient new normal"; to better understand the capacity for walking and cycling; and to make evidence-based decisions about how space is used at transport interchanges more widely.

Theme 9

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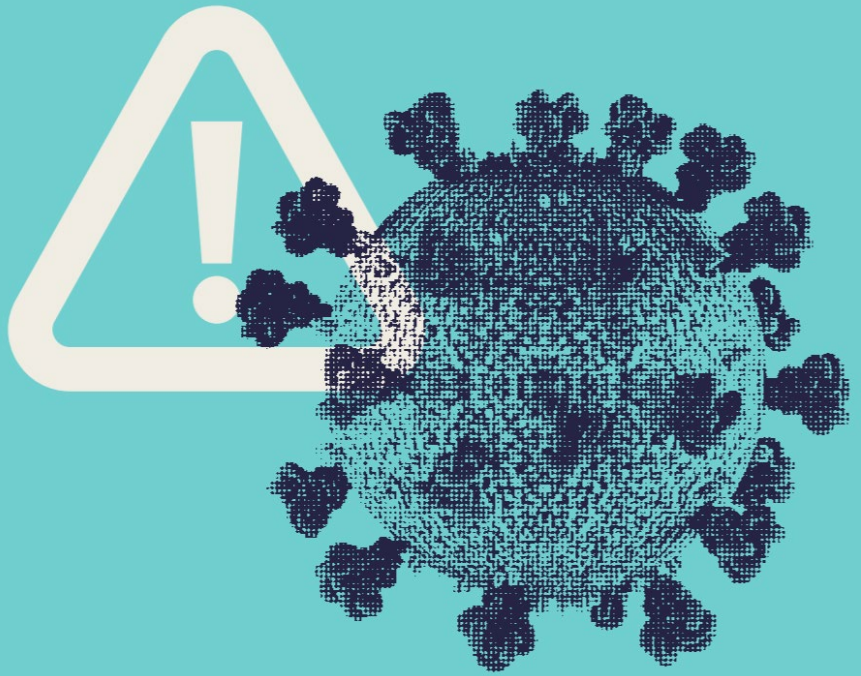
The focus is beginning to shift towards building future resilience



Theme 9

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Although mitigating the immediate effects of the health crisis initially took precedence, policymakers and public services later began to consider how AI and data-driven technology could be used to build resilience to **future emergencies** - both a resurgence of COVID-19 specifically, and other pandemics and health crises.

A number of these use-cases were as simple as further **integrating those data solutions that were developed at the start of the pandemic into existing systems,** whilst others involved the creation of new COVID-19 prediction models (revealing how infection rates might evolve over time) , as well as more general modelling to protect against future pandemics.

We also saw efforts to strengthen data and digital infrastructure - such as the launch of Nvidia's supercomputer - which have **laid the foundations for more rapid data-driven responses in future crises**.

Theme 9: Repository Examples

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- **The British Heart Foundation (BHF) flagship project UK C19-CRC uses AI to measure increased acute and longer-term cardiovascular risk in COVID-19 patients.** The project uses novel AI techniques applied to CT chest scans to accurately measure the level of inflammation in the patient's' arteries, which is suspected to be a cause of severe responses to COVID-19. These results will be combined with previous CT scans in many patients with existing heart disease and repeat CT scans after infection has subsided, allowing a direct comparison of inflammation before, during and after infection to understand whether COVID-19 has lasting effects on heart health. These AI methods were developed by Professor Charalambos Antoniades, Professor of Cardiovascular Medicine at the University of Oxford, who leads the project with collaborators across the UK.

- **Project TRACK (Transport Risk Assessment for COVID Knowledge) is a major study to understand the risks of COVID-19 transmission on public transport, and to identify the best measures to control it.** The 18-month study is developing models that simulate the way the virus could be transmitted and quantify the risk (in probabilistic terms) faced by passengers and transport staff. Models are informed by fieldwork conducted on buses and trains in London, Leeds, and Newcastle, with support from the Department for Transport and several transport organisations.

- **Intellegens has received funding from Innovate UK to model COVID-19 data and improve the management of future coronavirus outbreaks and other infectious diseases**. The tool, which will be based on Intellegens' deep-learning algorithm, will help understand how policy changes might impact outcomes, helping inform decision-making.

Theme 10

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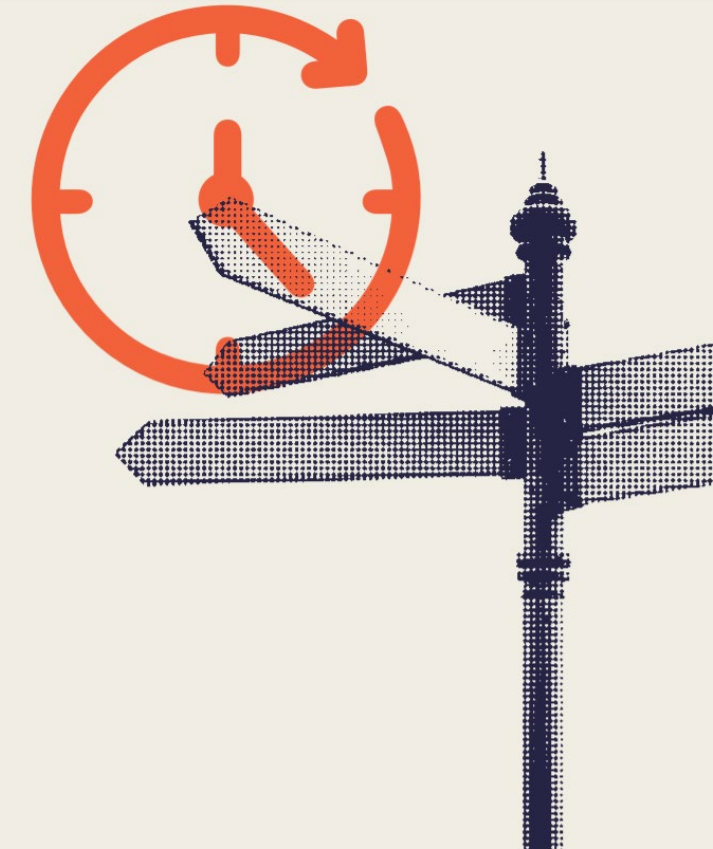
Data sharing across borders facilitated the discovery of new vaccines and treatments



Theme 10

We have already seen how UK-based organisations shared data with domestic partners in order to accelerate COVID-19 relief efforts. However, our COVID-19 repository also revealed that many organisations were sharing data with counterparts based overseas.

International collaboration of this kind served multiple purposes. Most **significantly it helped in the discovery of potential treatments and vaccines** for COVID-19, providing valuable research material for scientists across the world. International data sharing has also given the public and media community a clearer understanding of how the crisis has played out in other countries. The Johns Hopkins COVID-19 Dashboard was an important source of information on global case rates, particularly at the start of the pandemic. More recently, tools like the COVID Border Accountability Project have allowed the public to track pandemic-related restrictions.

Looking to the future, we may see greater international collaboration on resilience programmes, as **researchers share models for forecasting** the future of COVID-19, and governments develop strategies for re-opening different parts of the economy.

However, although there were promising elements to the pandemic response, obstacles such as the **difficulty in accessing reliable data** (especially across different geographies) were highlighted by many, including the AI & Pandemic Response sub-working group of the Global Partnership on AI. Collective work to remove these obstacles will be vital to ensuring that data-driven technologies and AI are used to their full potential in the future.

Theme 10: Repository Examples

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- **COVID Moonshot is an initiative aimed at crowdsourcing ideas from scientists that could accelerate the development of COVID-19 antiviral drugs.** The group began in March 2020 as a partnership between PostEra, a UK-based start-up, and Diamond Light Source, a British government science lab. Any scientist can view submitted drug designs and experimental data to inspire new molecule design ideas.

- **The Milken Institute's FasterCures project is tracking hundreds of potential COVID-19 treatments and vaccines.** For each candidate, the project's database lists its category (e.g., DNA-based vaccines, cell-based therapies, et cetera), a brief description, its stage of development, "anticipated next steps," funders, and more.

- **The Allen Institute for AI partnered with leading research groups to prepare and distribute the COVID-19 Open Research Dataset (CORD-19),** a free resource of over 44,000 scholarly articles about COVID-19 and the coronavirus family of viruses for use by the global research community. The dataset mobilised researchers to apply recent advances in natural language processing to generate new insights.

- **The MIDAS Network has released an online portal for COVID-19 modeling research.** The portal improves navigation of COVID-19 information, and includes a COVID-19 forecasting hub bringing together over 20 COVID-19 forecasting models, modelling strategies for reopening universities, and other modelling research. Moving forward the online portal will be used as a landing page for COVID-19 data and information, as well as a COVID-19 GitHub repository for sharing of computable (CSV) files with data, parameter estimates, software, and metadata.

Public attitudes towards data-driven tech responses to the pandemic

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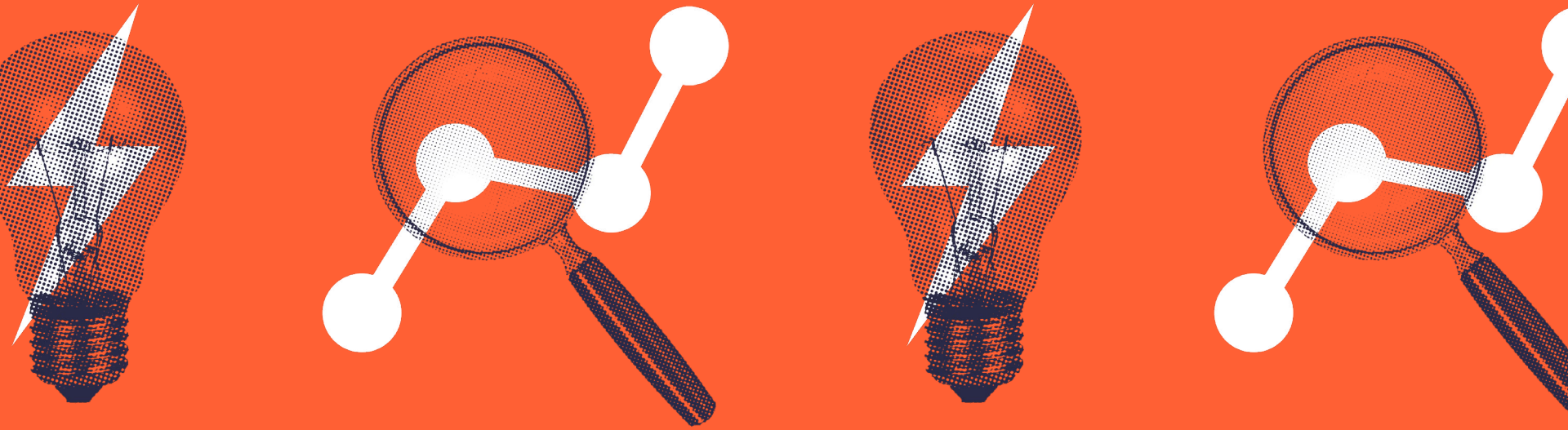

Research objectives

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In the UK's response to the COVID-19 outbreak, digital technology, including uses of data and AI, have been used in the immediate public health response, as well as to plan for longer term recovery. We sought to explore public trust during this period of significant change in the use of data-driven technologies, in order to understand whether this rapid deployment and adoption of technology has been aligned with public values and trust.

By polling a group of over **12,000 individuals**, we looked to understand:

"What are public attitudes towards the use of data and data-driven technologies in the UK's COVID-19 response?"

The polling was conducted over the **six-month period from June - December 2020**, as the COVID-19 pandemic and response evolved. Using a variety of statistical techniques, we explored this dataset to understand:

- How attitudes have changed over the six-month period
- What is, (and interestingly, what isn't), driving these attitudes
- How attitudes vary by different segments of the population

We also conducted **media analysis** over the same time period to overlay how digital and data-driven technologies were being discussed in the UK media at the time of polling, and how this may have impacted public attitudes.

Summary of findings

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- **COVID-19 has seen a significant expansion in the use of data-driven technologies**. The public sector has used these technologies to tackle the pandemic and to mitigate its consequences. People are also using these technologies to communicate, shop and learn to a level that is unprecedented before the virus. Alongside this there has been a 54% increase in UK media coverage of data-driven technologies during the first year of the pandemic.

- **A large proportion of the population feel positive that technology has a role to play in tackling the pandemic**. This view has been largely consistent throughout the pandemic (NET +63 support for the statement). There was also consistently high levels of support for a range of potential use-cases of technology which were being discussed in the media.

- **To realise a sustainable increase in the use of new technologies, the analysis suggests the critical importance of building and maintaining trustworthy governance.** Multivariate analysis on a range of attitudes, behaviours, and demographic variables found that "trust in the right rules and governance being in place" is the strongest driver for belief that digital technologies have the potential to be used in the COVID-19 response and recovery. Trust in governance was significantly more important than views about technology's efficacy or concern about the pandemic.

- **It will be important to ensure that this governance works for all citizens.** There is relatively low knowledge about where to raise complaints in cases where data-driven technologies have caused harm, with 45% of people not knowing where to do so. The lowest levels of knowledge are among older people.

Methodology

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- Over the period of **June - December 2020**, the CDEI commissioned **six surveys** to understand public attitudes towards the use of digital technology to mitigate the effects of the coronavirus pandemic.

- Each online survey (conducted on behalf of the CDEI by Deltapoll) asked the same set of questions **every month** to over **2,000 members of the public**, representing all regions of the UK. Results were weighted to be representative of the UK adult population as a whole.

- By combining all six datasets, we are able to analyse the results from a **total population of 12,113 respondents**. This form of analysis allows us to see which findings have been consistent over the six month period, but also gives us a larger sample size to explore demographic subgroups.

- On this combined dataset, we conducted **regression analysis** to examine what was driving results, and **cluster analysis** to identify similar groups of respondents based on their data from a range of variables, thereby segmenting the population into three distinct clusters.

2,000 adults in the UK polled every month:

- **Wave 1:** 24th - 26th June 2020
- **Wave 2:** 20th - 24th July 2020
- **Wave 3:** 10th - 14th August 2020
- **Wave 4**: 20th - 24th September 2020
- **Wave 5**: 16th - 22nd October 2020
- **Wave 6**: 11th - 18th December 2020

Snapshot of digital and data habits and awareness in the UK

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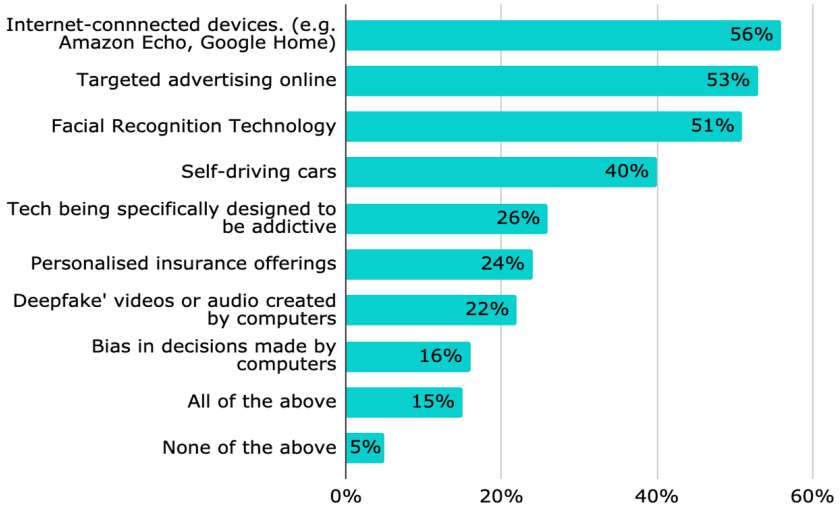
Whilst the **use of digital platforms is reasonably high**, when it comes to news consumption, **traditional news sources such as TV and radio still dominate** above social media and internet platforms. **Awareness of ways in which data can be collected and used in society is fairly low**, and this was consistent across the 6 month polling period.

"Which of the following are you aware of?"



"Which of the following do you use?"

66%	66%	65%	65%
37%	31%	20%	15%

% of the population who use each platform

"Which platforms do you use for news?"

TV 80%	Radio 48%	Word of Mouth 37%	Social media 36%
Newspaper 34%	Internet 34%	Internet (phone) 25%	Magazines 14%

% of the population who use each platform

Consumers have increased their use of digital technology

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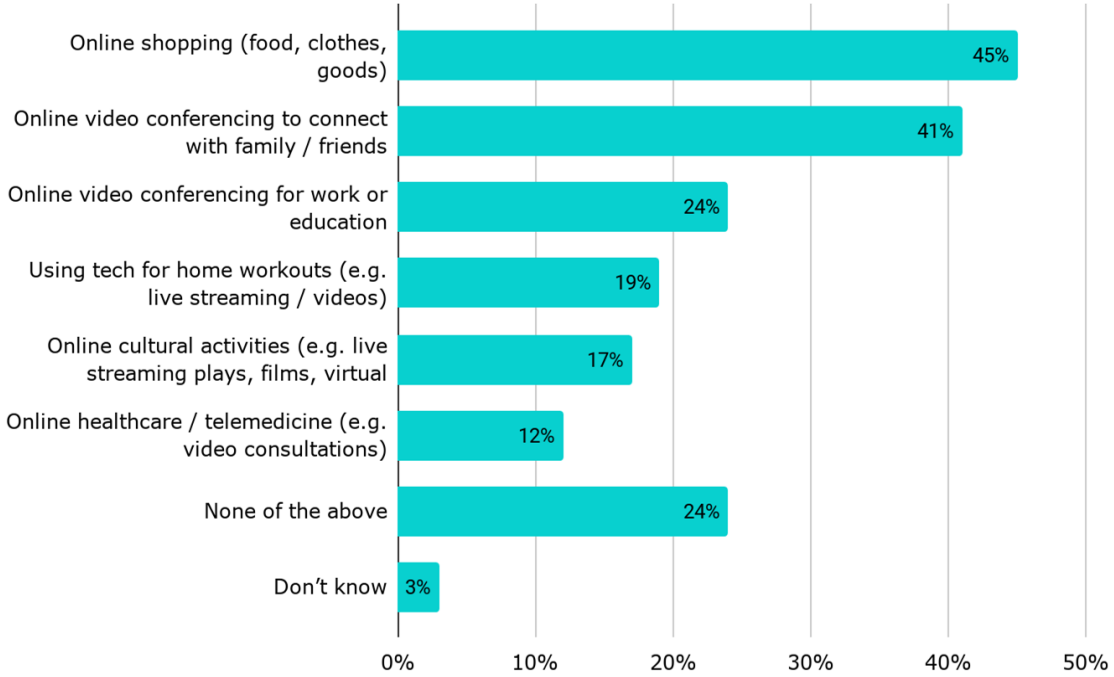
- The **public's use of digital technology has increased since the start of COVID-19**. This finding was consistent across demographics and over the six month time period.
- Whilst impossible to predict future behaviour, individuals indicated that they were planning on **continuing to use this technology in the long-term.**

"Which of the following have you done either for the first time or significantly more of during the COVID-19 outbreak?"



But proactive management of users' online experience was low

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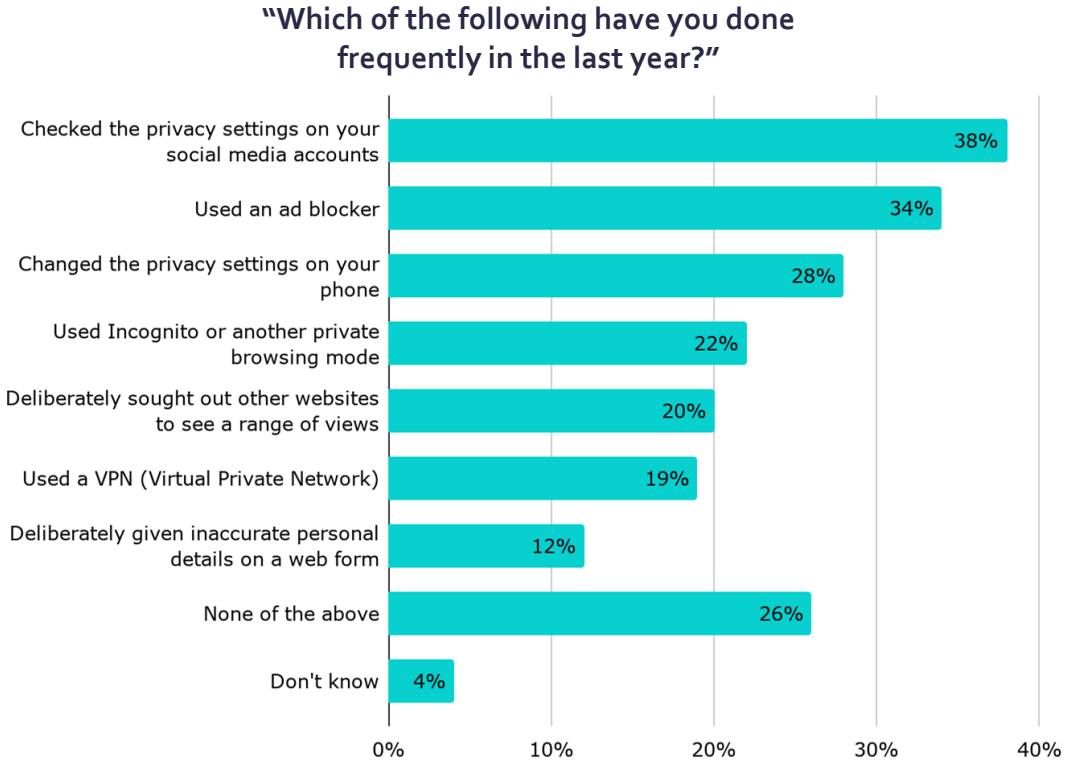
- Despite this, the proportion of the UK public who had taken **proactive measures to managing their data or online experience was fairly low,** with 26% of the population saying they had done none of the protective measures listed.

- This shows that the mechanisms currently in place are not working, a finding consistent with the **CDEI's 'active choices' research** with the Behavioural Insights Team and Doteveryone. In this, we are looking to understand how, by changing how technology is designed, users can be **enabled and encouraged to make more 'active choices' about their online experience.**



Key events in the COVID-19 response during survey period*

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23 March	Lockdown and furlough scheme announced in England
23 April	NHSX contact tracing app announced
5 May	Isle of Wight trial begins
10 May	First easing of lockdown in England
28 May	NHS Test and Trace launches
1 June	Lockdown eased (schools open)
18 June	England switches to contact tracing app based on Apple / Google API
29 June	Leicester enters local lockdown
4 July	Lockdown eased further
31 July	Northern Ireland launches contact-tracing app
17 August	Ofqual ends plans to use an exams algorithm
10 September	Scotland launches contact-tracing app
24 September	England and Wales launch contact-tracing app
12 October	England moves to three-tier COVID-19 system
1 November	Second national lockdown announced in England
2 December	England moves to strengthened three-tier system

*Please note this list is not intended to be exhaustive and for legibility, is focused on England's response.
Source: *The Guardian (December 2020), Covid chaos: how the UK handled the coronavirus crisis*

Media coverage of data-driven technologies has increased

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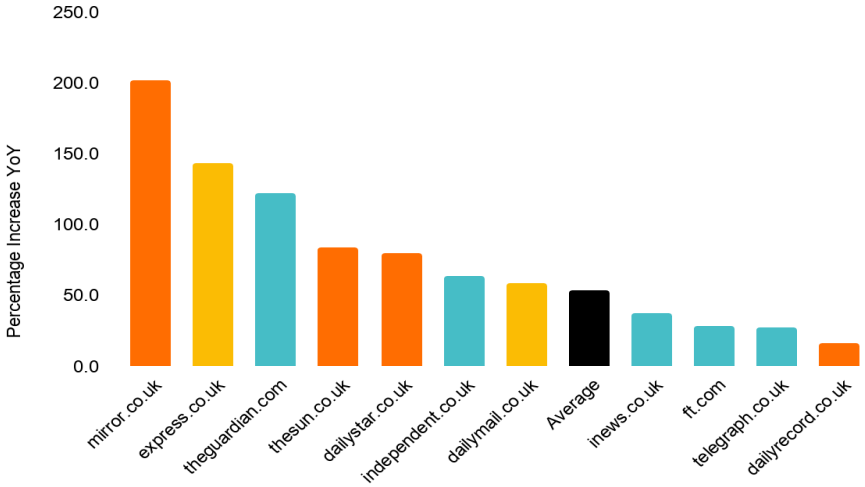
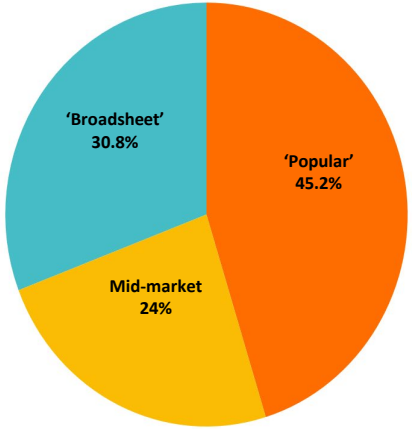
When looking at media coverage about data, AI and data-driven technologies, unsurprisingly, we see a large increase since the start of the COVID-19 pandemic. There has been a **54% year-on-year increase in the number of articles in UK newspapers with terms such as 'data-driven technologies', 'artificial intelligence and 'algorithm'** from the period Feb 2019-Feb 2020 (pre-COVID), compared with Feb 2020-Feb 2021 (post-COVID)*. This uplift is driven by articles directly and indirectly related to the pandemic.* When broken down by media outlet, the increase is shown to be from popular media outlets** (e.g. *The Mirror*, *The Sun* and *The Daily Star*).





Popular - Another name for tabloid newspapers, aimed at a wide circulation

Mid-market - General name applied to titles that are smaller in format than a 'broadsheet but perceived to be less populist than a 'tabloid'

Broadsheet - national titles, or applied to higher-quality local, regional titles

**Source: Analysis conducted using Brandwatch over the period Feb 2019 - Feb 2021, using a defined query to search for data-driven technologies and words associated with the term in online articles of UK news sites. 46.8% of articles related to data in the post-COVID period were related to the pandemic. Events related to the consequences of the pandemic, such as the Ofqual examination algorithm, also contributed to the uplift. See Appendix 2 for more details.*

***Source: Definitions are taken from slide 90 in the Department for Digital, Culture, Media & Sport, Overview of recent dynamics in the UK press market, 2018, link here.*

Attitudes towards the use of tech in the COVID-19 response

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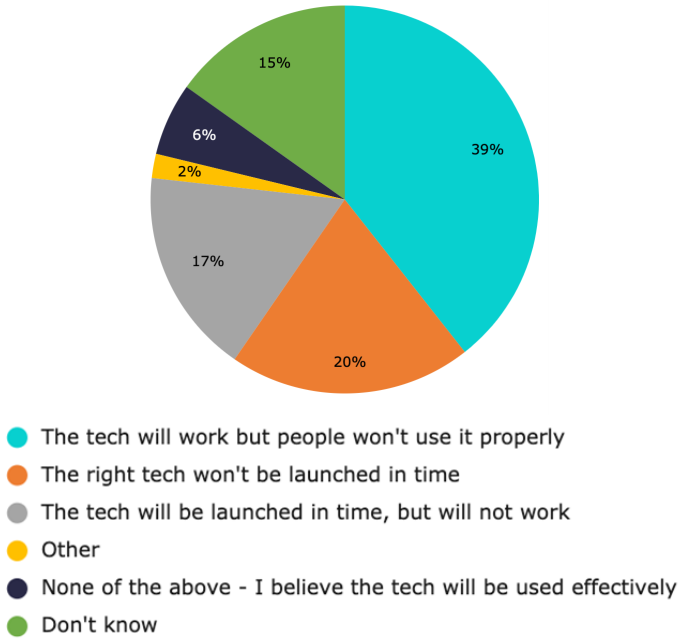
- In the combined dataset, almost three-quarters **(72%)** of the UK population believe that digital technology has the **potential** to be used in response to the COVID-19 outbreak. This belief is consistent across all demographic groups and regions, and is consistent over the 6-month study.
- But not everyone thinks this potential is being realised - when asked about how technology is **currently** being used in response to the outbreak, fewer than half **(42%)** believe that digital technology is making the situation in the UK better.
- However, only very small numbers **(7%)** believe it is actually making things worse.
- When asked the main reason as to why digital technology might not be effectively used in the COVID-19 response, 39% of the public said they thought the technology would not be used properly, rather than problems with the technology itself.

"Which of the following would you say is the main reason why digital technology might not be effectively used in the response to the COVID-19 outbreak?"



Testing individual use-cases

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- **To test whether the public response to abstract statements about data-driven technology would be echoed with real-world potential uses,** we provided respondents with a small selection of specific case studies from our COVID-19 repository.
- Despite low levels of awareness for these potential use-cases, the research showed **high levels of instinctive comfort with these technologies**. For all three cases, a majority of respondents (average 69%) believed the examples could be helpful in dealing with the outbreak and its aftermath.
- Respondents were also comfortable with these technologies being applied to them, with an average of 63% of respondents feeling **relaxed about them being introduced in their local area.**
- Despite this level of comfortability, these use-cases have not been implemented on mass. This points to an 'opportunity gap'- a chasm between technology's potential and the reality of how it has been applied.

Wearable technology for social distancing in the workplace

The use of **personal data** (including health data) to inform **local lockdowns**

The use of **business data** to help policymakers at a local and national level understand where best to direct **financial support**

***Note**: These case studies were based on potential use-cases that were being debated in the media and civil society in summer 2020, and do not reflect engagement with Whitehall policymakers.*

Consistent confidence in technology

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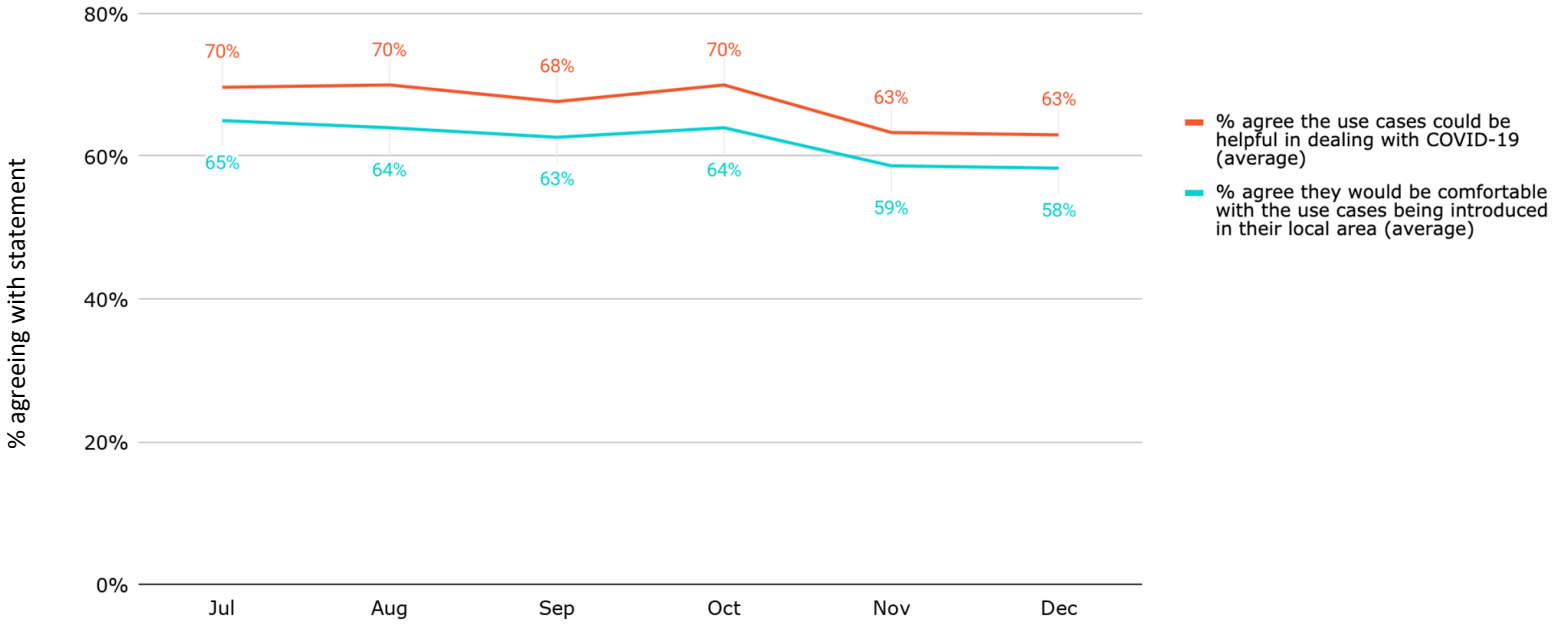
This positivity towards the introduction of three specific data-driven use-cases was **fairly consistent** over the 6-month period from July to December. Interestingly, from November onwards (and the beginning of the second lockdown), there is a **dip in positivity and comfortability towards the use-cases**. More research would have to be conducted to understand if this is the beginning of a longer term trend, or an anomaly.



Perceived helpfulness varies by use-case

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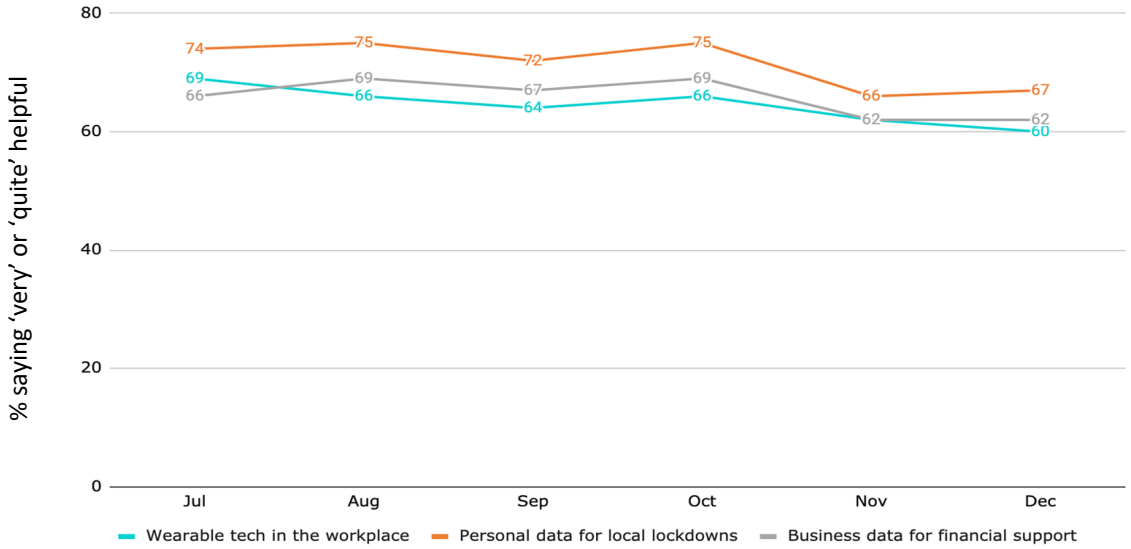
There was consistently a high level of perceived usefulness of the three use-cases tested. Of these use-cases, there was highest support for the use of personal data to inform local lockdowns. This fell, alongside the other two use-cases, when the second lockdown was implemented in November.

"How helpful do you think this example could be in dealing with either the COVID-19 outbreak or its aftermath, if at all?"



Perceived comfortability varies by use-case

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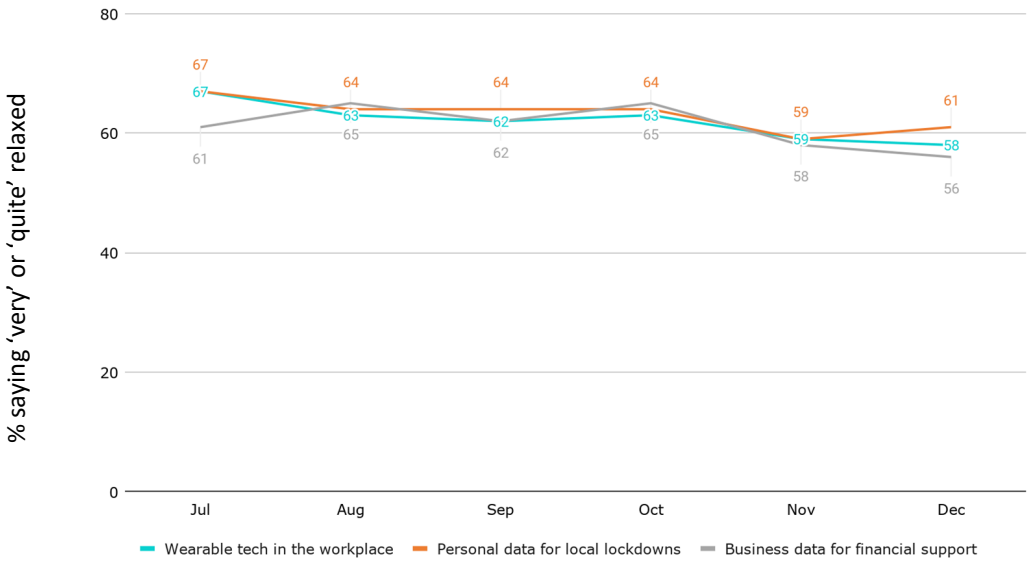
When looking at the break-down by use-case for comfort with the use-case being introduced, we see consistency up until November (and the second lockdown), after which there is downward trend in the proportion of the public stating they are comfortable with these use-cases being implemented in their local area.

"How would you feel about the example being used in your local area to deal with the COVID-19 outbreak or its aftermath"



Segmentation analysis

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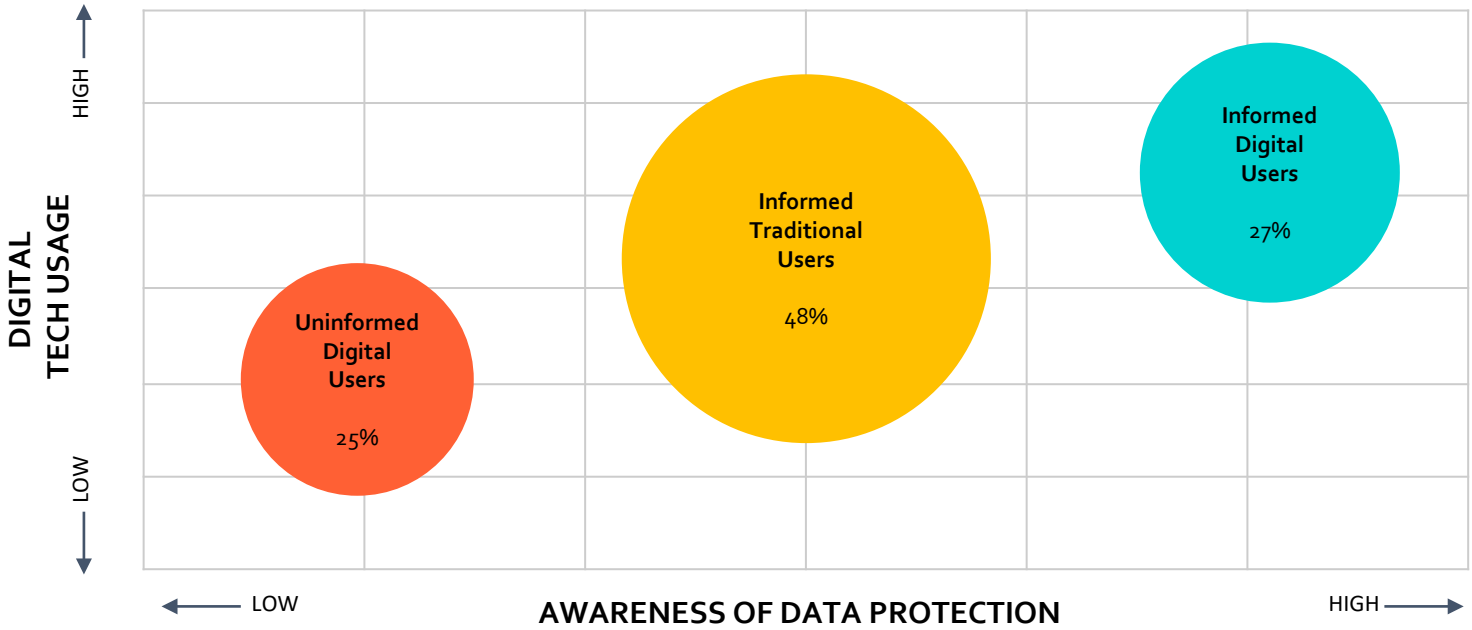
We conducted **segmentation analysis** to investigate whether attitudes towards the use of data-driven technologies differed by groups of people. Segmentation is a way of grouping respondents based on the **similarity of their characteristics and attitudes,** as measured by the survey responses. These three segments showed little change throughout the six month period.



Segmentation analysis: Demographics

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THE "*INFORMED DIGITAL USERS*"

% of population

27%

*Mean age**

41

- Highest level of social media usage
- Highest awareness of digital technology and data protection
- Highest level of news consumption - more likely to get news from social media than a printed newspaper

THE "*INFORMED TRADITIONAL USERS*"

% of population

48%

Mean age

52

- Lowest level of social media usage
- Medium awareness of digital technology and low awareness of data protection
- High degree of news consumption via traditional channels e.g. TV. More likely to read news in a printed newspaper than social media

THE "*UNINFORMED DIGITAL USERS*"

% of population

25%

Mean age

48

- Average level of social media usage
- Lowest awareness of digital technology and lowest awareness of data protection
- Low level of news consumption

*Note that only those aged 18+ were surveyed

Segmentation analysis: Attitudes

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Across all three segments, the public recognise the **potential that digital technology can play in the COVID-19 response.** However, there is a **lack of trust in the governance in place,** particularly for 'informed traditional users' and 'uninformed digital users'. Given the low levels of news consumption for uninformed digital users, this group may be the most difficult to reach.

	"INFORMED DIGITAL USERS"	"INFORMED TRADITIONAL USERS"	"UNINFORMED DIGITAL USERS"
% believe digital technology has the **potential to be used** in the COVID-19 response	86%	69%	65%
% feel **well informed** about how digital technology has been used in the COVID-19 response	41%	24%	28%
% **trust the right rules and regulations** are in place for digital technology	50%	39%	41%
% know where to **raise a complaint** if they are unhappy with the way digital technology is being used in the COVID-19 response	33%	19%	24%

Key drivers of attitudes

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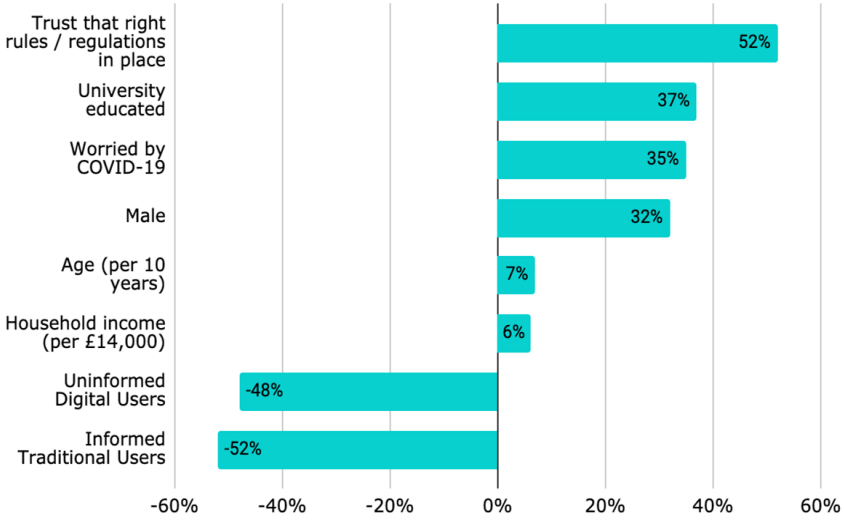
- We conducted multivariate analysis on the combined dataset of 12,113 individuals to explore the behavioural factors **determining an individual's likelihood to believe that digital technology has the potential to be used in the response to the COVID-19 outbreak**
- The **strongest predictor in our model is whether an individual trusts that the right rules and regulations are in place to govern the technology responsibly**. This indicates a strong relationship between trust in governance and public support for the adoption of new technologies.
- Other important predictors included being; university educated, worried about COVID-19, male, older, and having a higher household income.
- It is also **notable to observe which factors have much less predictive power**. This includes attitudes (belief in the efficacy of technology in the COVID-19 response, opinion on COVID-19 restrictions), some demographic information (ethnicity, location), and behavioural factors (news consumption, social media usage, attitudes towards the COVID-19 restriction).

% increase or decrease that each factor has on an individual's likelihood to believe that digital technology has the potential to be used in the COVID-19 response



(Limited) change over time

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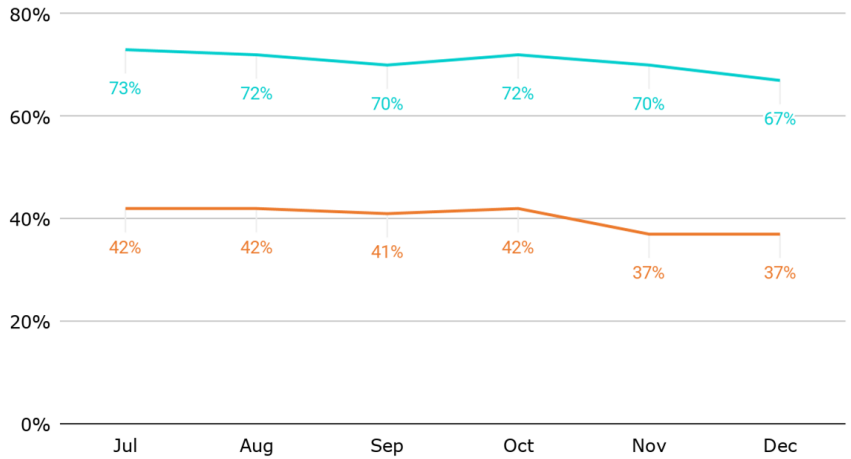
- It is notable that public attitudes towards the use of data-driven technologies have **remained relatively consistent** throughout the surveyed period.

- This is despite the **public profile and media coverage of data-driven technologies being particularly high** - media coverage in UK nationals about data and AI has been 54% higher than last year, before COVID-19. This media coverage has not translated to large shifts in public opinion.

- It is possible that COVID-19 will lead to **longer term shifts** in public opinion towards the use of data-driven technologies. Respondents in wave 6 (11th-18th December 2020) were 11% less likely to see a role for technology in the COVID-19 response. It is not clear whether this is a time-specific, or indicative of changing opinion.



Potential: % responding that digital technology could 'definitely' or 'probably' be used in response to the COVID-19 outbreak

Current: % responding that digital technology is currently making the problems caused by the pandemic 'a lot' or 'a little' better

Governance and the importance of trust

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- **A reasonable proportion of the public (43%) trust that the right rules and regulations are in place** to ensure that digital technology is used responsibly in the UK's COVID-19 response. 24% of people disagree with the statement. This is largely consistent across age, region and gender.

- When asked whether they would know where to raise their concerns if they felt this governance was failing, 39% of younger people would know where to raise these complaints. This falls to **just 14% for older people, suggesting that many would struggle to seek recourse following a negative experience.**

- For younger people, 40% agreed with the statement 'I feel well informed about how digital technology has been used during the crisis'. **Only 22% of those aged 55+ agree with the same statement.**

- Interestingly, despite this, older individuals were generally the **most relaxed about digital technology use-cases being implemented in their local area**. Older people were also less likely to take proactive measures to manage to their data. They were less likely to have changed their privacy settings or used a Virtual Private Network (VPN) than younger people.

% agreeing with the statement:
"If I was unhappy with the way digital technology was being used, I would know where to raise my concerns"

18-35 year olds *55+*

% agreeing with the statement:
"I feel well informed about how digital technology has been used during the crisis"

18-35 year olds *55+*

'Younger = below 35; 'Older' = 55+

Appendix

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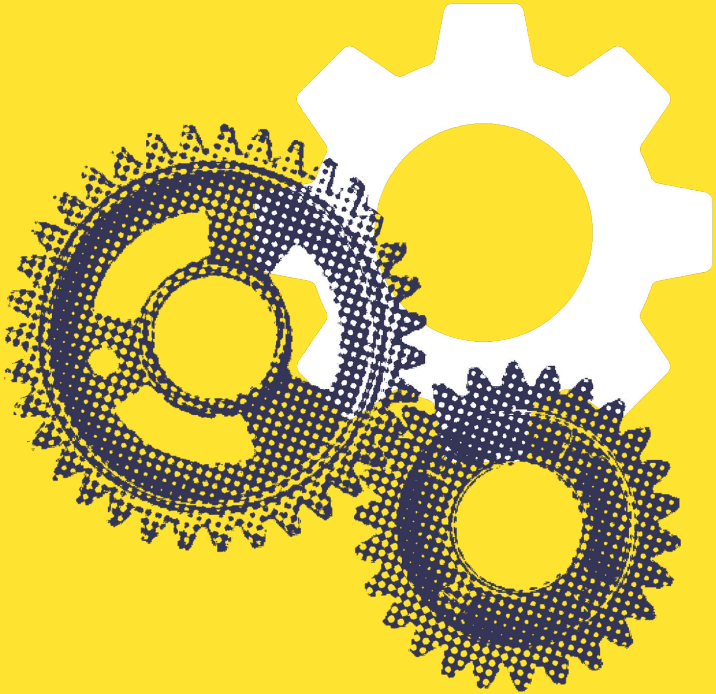

1. Methodology for multivariate analysis

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Aim

- The aim of this multivariate analysis is to analyse the public attitudes towards digital technology being used to control COVID-19. To achieve this two types of analysis were conducted.
- Regression analysis focuses on identifying the main factors determining individuals' likelihood to see potential in digital technology being used to respond to the COVID-19 outbreak.
- Cluster analysis uses statistical techniques to identify similar groups of respondents based on their data from a range of variables. This is then used both in the regression analysis, but also to segment the sample into an intuitive taxonomy to aid understanding of the aggregate results and of the population as a whole.

Methodology

- To address the research question, a survey dataset, covering 12,113 individuals and representing all regions of the UK, was used.
- The survey was conducted at six different points in time, allowing to analyse changes over time. The survey participants were asked whether they believe that digital technology has the potential to be effectively used in the response to the COVID-19 outbreak. The participants were able to choose from the following answers: could definitely not be used (1), could probably not be used (2), unsure (3), could probably be used (4), could definitely be used (5). The corresponding variable was treated as the dependent variable.
- Attitudinal variables, such as social media usage, technology awareness, and concern about the COVID-19 outbreak were treated as the independent variables of main interest.
- A cluster analysis was also conducted, grouping individuals into three different segments based on their (social) media usage, their app download frequency, and digital literacy (digital technology and data protection awareness). This segmented respondents but help to reduce the number of independent variables, to increase the viability of the regression model.
- In addition, socio-economic variables, such as age, gender, income, ethnicity, and education were used as control variables.
- Due to the nature of the dependent variable (values are ranked on a Likert scale), an ordinal logistic regression was applied to analyse the effects of the independent variables on the dependent variable. In order to avoid biases caused by heteroscedasticity, robust standard errors were estimated.

2. Media Analysis

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Media analysis was conducted using Brandwatch, using a 'query' to search for online articles from a set list of sources in the UK.

Query

(artificial NEAR/2 intelligence) OR artificialintelligence OR algorithm*
OR (data NEAR/10 (technolog* OR "artificial intelligence" OR artificalintelligence OR algorithm*))
OR ("data-driven" NEAR/1f tech*) OR ("data driven" NEAR/1f tech*) OR (datadriventechnolog*)
OR "machine learning" OR machinelearning OR (AI NEAR/2 governance) OR (AI NEAR/2 regulation) OR (AI NEAR/4 data) OR "deep learning" OR deeplearning

Sources

The sources chosen were the online sites for media outlets included in in the 'Quality','Mid-Market', 'Popular', 'Freesheets', 'Online news' and 'Magazines' from slide 90 in the Department for Digital, Culture, Media & Sport, Overview of recent dynamics in the UK press market, 2018, link here.
The categories 'National', 'Mid-market' and 'Popular' are also defined using this source, with the 'Quality' classification being the 'National' category.
The sites searched were;

www.thetimes.co.uk	inews.co.uk	heraldscotland.com	www.bbc.co.uk	metro.co.uk
www.telegraph.co.uk	www.theguardian.com/uk	irishtimes.com	www.thesun.co.uk	www.standard.co.uk
www.ft.com	pa.media	independent.ie	www.mirror.co.uk	www.itv.com/news
www.dailymail.co.uk	independent.ie	www.economist.com	www.dailystar.co.uk	news.sky.com/uk
www.independent.co.uk	www.dailyrecord.co.uk	www.cityam.com	www.express.co.uk	www.channel4.com/news


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