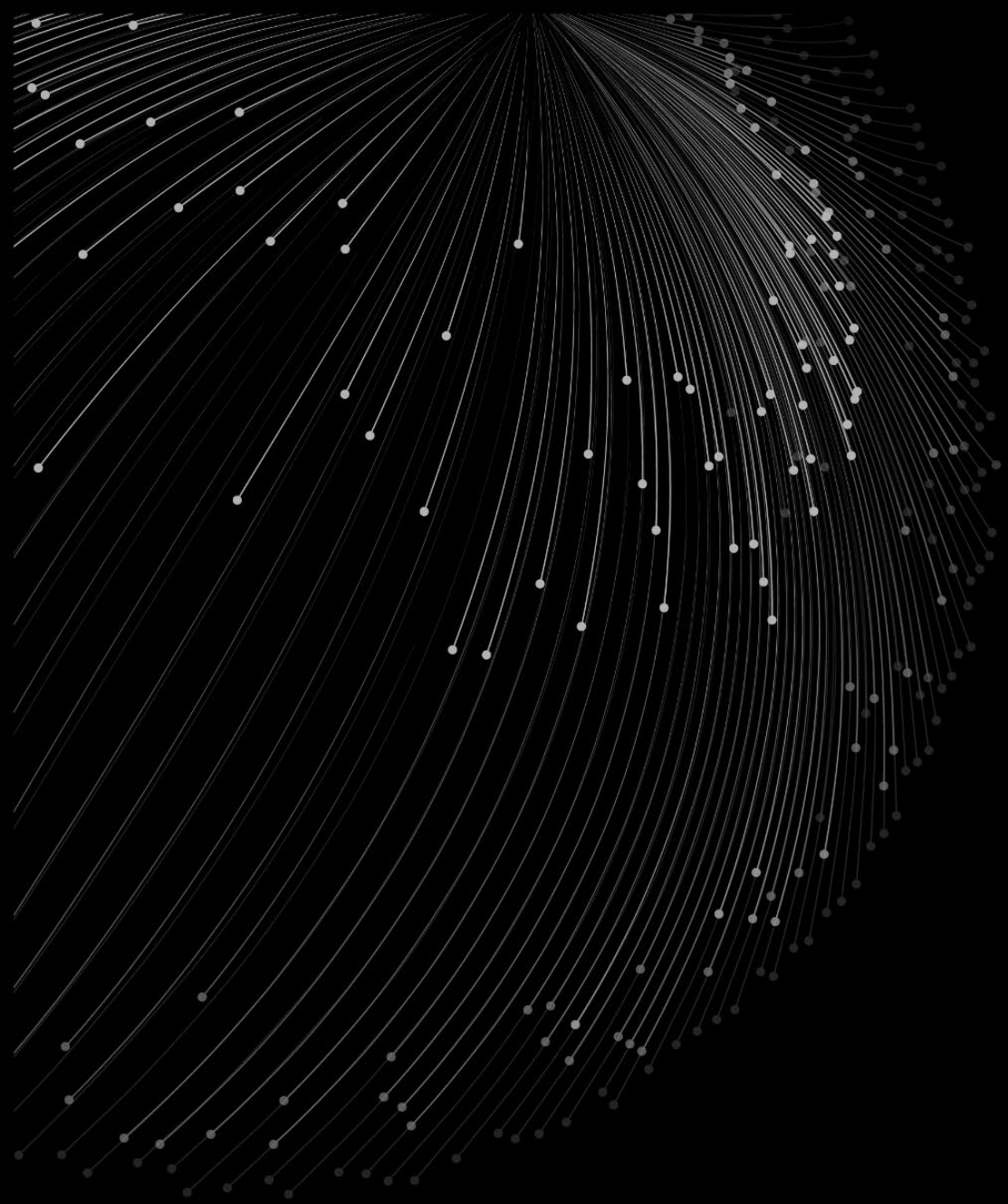


faculty

Automated approaches to measuring online experiences: Executive Summary

June 2021

1. Introduction and key findings

Ofcom commissioned Faculty, a specialist data science and artificial intelligence firm, to carry out a feasibility study to assess the range of automated online tools and methodologies that measure online experiences. The study also highlighted some of the legal and ethical challenges associated with using these tools.

This work informs Ofcom's own research programme and practical use of such tooling. We are publishing this Executive Summary in order to contribute to wider research in this area, and it should be noted that the views expressed in this document are those of Faculty rather than those of Ofcom.

Context for Ofcom commissioning this work

Understanding the online world is becoming increasingly central to much of Ofcom's remit. Many of the sectors that Ofcom has traditionally regulated now have blurred boundaries - with for example TV and radio increasingly being consumed online, in more flexible, on-demand ways. Ofcom already has some online regulatory responsibilities– including the regulation of Video Sharing Platforms falling under UK jurisdiction - and is set to gain new ones as set out in the Government's draft Online Safety Bill. And beyond these, Ofcom has wider duties to promote media literacy and research consumer behaviour, as well as competition powers that apply to some services delivered online.

Ofcom, like other regulators and public bodies internationally, therefore, needs to measure people's online experiences and platform activities/behaviours at scale. It needs to be able to understand at a macro level people's experiences and usage of online environments, as well as fine-grained detail on specific research questions.

The sheer vastness and diversity of online experiences makes meaningful measurement a challenge requiring investment and innovation. The scale and variety of online platforms, and algorithmic personalisation of content, means that there is essentially an infinite number of possible user journeys, making it hard to arrive at both meaningful summary insights as well as fine-grained assessments of particular issues.

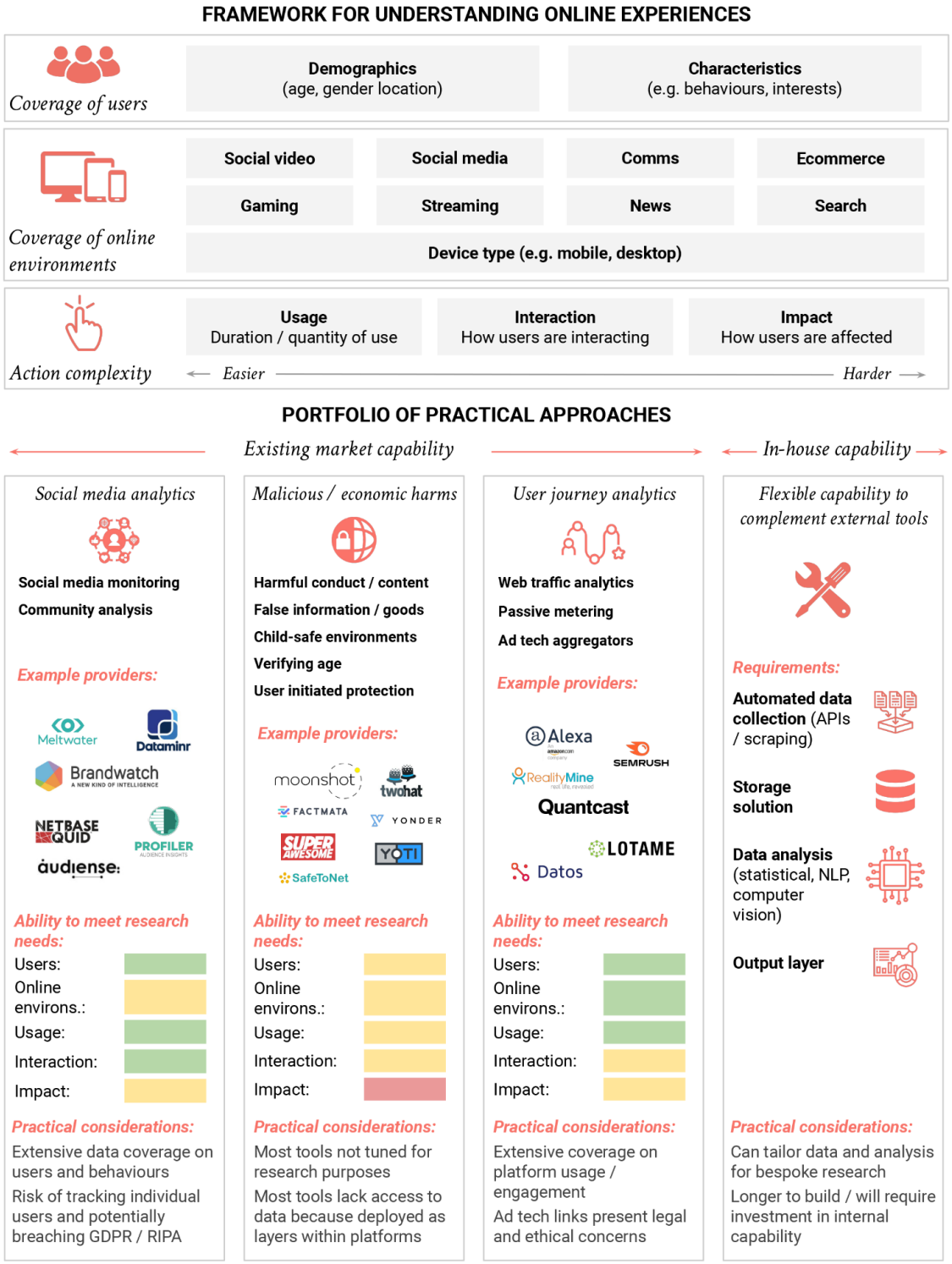
Ofcom has a long-established social research programme, which is already helping to map and understand people's online experience, and wants to keep innovating to complement this with latest developments in automated approaches and tooling. Classical social research techniques alone are not able to wholly address the huge diversity in online experiences that Ofcom may be required to assess. Surveys, in-person tests, and self-reporting are excellent at capturing qualitative and quantitative information about experiences, in particular for understanding the drivers for specific online behaviours, but these methodologies can be expensive and it can take several months of fieldwork and analysis to get robust insights.

Automated tooling has an important and potentially powerful role to play in helping Ofcom to measure online experiences better. However, utilising such tooling effectively is not straightforward: care needs to be given to how to use tools as part of a holistic programme rather than piece-meal; how to extract meaningful and reliable insights with understanding of potential inaccuracies or bias; and how to mitigate the legal and ethical risks associated with mass data collection.

This project mapped the landscape of online experience measurement, market tooling, and underpinning data science techniques and approaches, providing Ofcom with assessments of what different tooling capabilities and specific tooling types can do in practice. Whilst this project was set up to inform internal development of Ofcom's capabilities in this area, it is helpful to share this Executive Summary document publicly as we recognise the work will be of interest and value to a range of stakeholders.

Key findings

There is a growing and evolving range of tooling and methodologies designed specifically to measure online experiences. Data is absolutely inherent to their usefulness: at their core, most tooling and methodologies are underpinned by data science / AI[1], involving a data collection step and a data analysis step to deliver insights. This work has mapped and assessed that landscape, set out in an overall summary diagram below:



[1] AI being machines that perform functions that require intelligence when performed by people, and data science being the discipline of applying the scientific method to data in order to extract insights and inform action.

We also set out a range of key findings which could be relevant for a wider set of stakeholders and organisations looking to incorporate such tooling into their own research into online experiences:

Overall

- **There is strong feasibility for using online tools and data capture and analysis methodologies to research online experiences at scale.** Such tooling can significantly improve the scale of data collection for research and can allow the analysis of a wide range of online experiences very rapidly compared with classical social research techniques alone. In the near term, the external tooling market can already address many research and analysis requirements which organisations like Ofcom will have, and, in the longer term, this market will expand further.
- **Despite its importance, automated tooling will have key limitations, now and into the future**. In particular, there are specific challenges with mapping journeys for specific user segments (demographic profiles). It is relatively rare on many platforms for users to list their age or gender, requiring AI to estimate user demographics, meaning that proxies or algorithmic-based estimates of user segments by clustering often have to be used.
- **There are clear legal and ethical considerations which organisations should account for when utilising automated tooling, but these should not present an outright blocker as long as a practical plan is developed and iterated.**

Automated tooling market

- **The external market for tooling and services is already relatively advanced and continuing to grow.** Even in the past three years, a number of new companies have been created to address what are sometimes relatively niche gaps in the current market capability to capture and analyse data automatically and at scale.
- **Social listening and web traffic analytics tooling are currently the most mature market segments, and most directly tuned for research use**. Many social listening tools have preferential access to social media APIs, with Twitter's firehose (complete stream of tweets) the most common, and all offer a range of out-of-the-box approaches to segmenting and analysing content and online users, which is often based on AI.
- **External tooling can add value quickly, and will be most effective at meeting well-defined and ongoing needs.** The degree to which the output of these tools can be tailored will vary. While many providers will enable users to create bespoke reports and dashboards using their tooling, typically smaller providers will be prepared to engineer new features or give access to new data sources to support specific analytical requirements.

Data access

- **We carried out research into API and web scraping-based data access across a range of the largest Communications Service Providers (CSPs) and websites, which found strong open-access availability for organisations looking to complement external tooling with in-house data collection and analysis.** However, in doing so, organisations should be mindful of CSPs' Terms of Use.
- **Beyond what is open-access, many external tooling providers have preferential access to data provided by CSPs and other data owners which greatly improves their appeal.**

Legal and ethical considerations

- **Care should be taken to ensure that mass data collection is legally compliant.** This is especially true of tooling deployed for automated data collection at scale from open source and social media platforms, and risks associated with inadvertently collecting personally identifiable information. Steps should be taken to anonymise data during data processing where possible.
- **The proportionality and ethics of mass data collection should also be carefully considered.** The major differentiators between traditional social research methodologies and the automated approaches considered in this report are consent and transparency.

Implementation considerations

- **This work has underlined the importance of a multi-method, cross-disciplinary, multi-source approach for an effective overall research programme into online experiences.** Automated tooling should complement traditional social research methods to understand online experiences, not seek to replace them.
- **Effective use of automated tooling will require multi-disciplinary skills across research ethics, data science, statistics, social research, and behavioural science.** Particular care should be given to the statistical interpretation of analytical findings: where there are risks around sample/data or algorithmic bias, and/or the 'black box' nature of many tools/approaches giving misleading impressions of accuracy.
- **Successful use of automated tools requires careful research design** - in particular needing clear research questions upfront to inform which data is collected and analysed. This might be achieved by having clear hypotheses to test, which data can be subsequently collected and analysed against.

Project methodology

The work was carried out by a multidisciplinary team of data scientists, technical consultants and online communications data specialists from Faculty. It involved over 40 interviews with key stakeholders across the sector, particularly executives from automated tooling providers; substantial desk research to analyse the market and assess different tooling provider offerings; and novel primary research to map the API-based data access to the most commonly used online environments and platforms.

2. Online experience measurement framework

It is helpful to create a structured, logical framework for online experiences, to give a basis to assess automated tooling against. Online experience can be broken into coverage (defining 'who' and 'where') and actions (defining 'what' and the user journey):

Coverage

Users	The users of internet services and hence people whose behaviour and experiences is to be understood online
Common demographics	Primarily insights on users related to age, gender, and location.
Other user characteristics	More granular insights related to certain user behaviours or interests exhibited online, and other harder components to measure such as specific vulnerabilities, which allow categorisation into further user segments.
Online environments	
'Platform' types[2]	Can be grouped into a broad range of categories: **social video, social media, communications, ecommerce, gaming, streaming, news, search**. Platforms are also increasingly multimodal (i.e. many social video platforms are also social media and communication platforms).
Device types	Principally mobile and desktop. It is useful to understand at aggregate levels how mobile or desktop usage varies, and more specifically how this impacts what users are doing or experiencing online.

Actions

Usage	Macro view of online use (i.e. how long users use platforms, when they use platforms, what they search for, etc.). This is more straightforward to measure.
Interaction	What people encounter online (i.e. who or what they come in contact with, and actions they take). This is more difficult to measure but still feasible.
Impact	What effect do actions and attributes of both user interactions and platforms have on users (i.e. how they change their behaviour or attitudes based on previous actions or the influence of their environment). This is hard to measure efficiently at scale, although it can be done well at smaller scale via classical social research.

[2] NB we use the term 'Platform' as the overarching summary term throughout this report when referring to this range of environments - which by nature includes both formal platforms (e.g. social video or gaming platforms) as well as regular websites.

3. Automated tooling and methodologies

There is a growing and evolving range of automated tooling and methodologies designed specifically to measure online experiences across the dimensions above. For the purposes of this research, we defined automated tooling and methodologies as:

Tools or techniques which carry out mass data collection, analysis or insights in an automated way, to significantly scale or augment the work of human analysts in understanding online experience

Crucially, these are designed to provide organisations with insights and analysis to complement human judgment, not replace it. This section gives a structured breakdown of the types of tooling available on the market, and introduces the data science workflow and techniques which underpin these.

Structuring the landscape of automated tooling and methodologies

There is no industry consensus on how the market for measuring online experience can be categorised, due to the rapid pace of change and the way that many of the relevant tools will only focus on specific aspects of online experience. Considering this, we have developed a categorisation which summarises the market into three broad capability areas:

Social media analytics Data collection and analysis techniques aimed at social media, which can measure aggregated user engagement with trending topics across different platforms	Social listening	Uses open source data to analyse / segment content and users
	Community / network analysis	Uses open source data to visualise networks of users interested in specific topics
Malicious and economic harms measurement Methodologies geared towards creating a safer internet that can be used to measure harmful online experiences, including economic harms	Detecting harmful behaviour and content	Detects and moderates manifestations of harm, both in terms of illegal harms and also legal but harmful behaviour
	Identifying false information / goods	Detects false information, including sources of misinformation / disinformation as well as consumer harm such as the sale of fake or misleading goods
	Child-safe environments	Design of online environments for younger audiences with the objective of keeping children safe
	Verifying ages	Used to protect children from age inappropriate content
	User-initiated protection	Deployed by users to protect against harmful material or experiences
User journey analytics Data collection and analysis techniques that focus on user journeys, in particular engagement and usage of websites / apps, and how it differs between users	Web traffic analytics	Analyses website traffic and engagement and segregates by demographic
	Passive metering	Uses crowd sourced consent to record user behaviour across online platforms and assess the impact of platforms on user behaviour
	Ad tech aggregators	Uses clickstream data, third party cookies, search data, purchase data, profile data, and many others to create curated profiles of internet users and activity

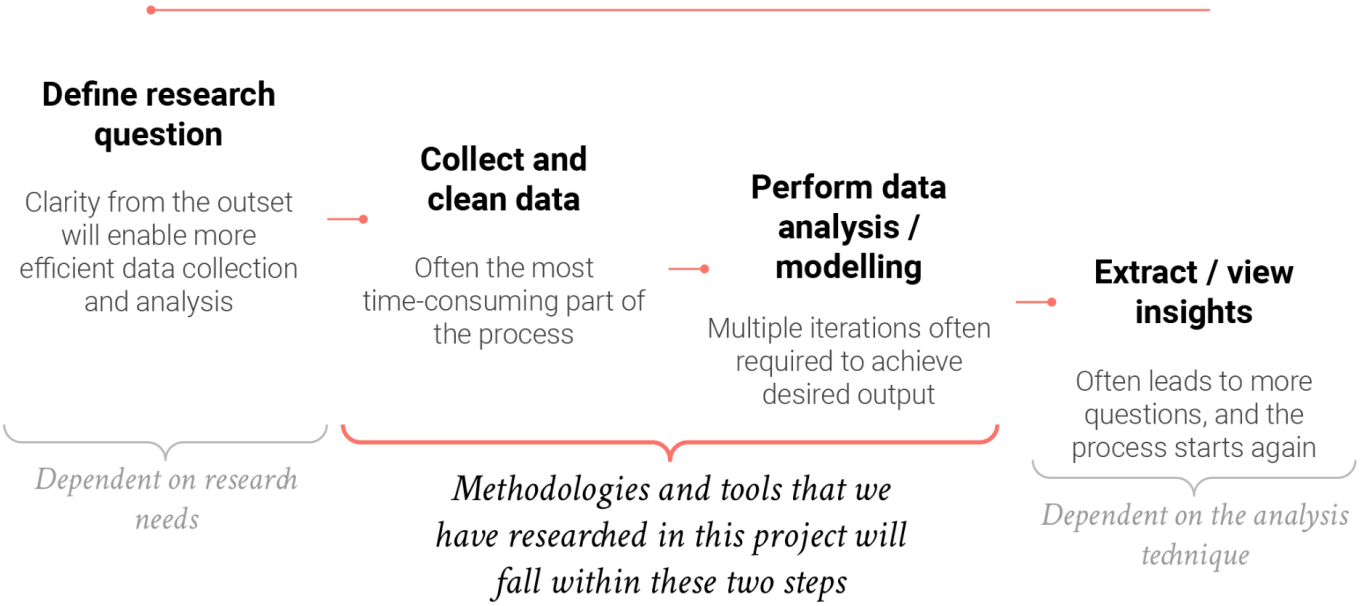
Social media analytics refers to a broad capability area that originated during the initial acceleration of social media in 2007, and has since diversified in response to surging consumer interest. Initially driven by private sector demand, this capability group has evolved to include analysis and insights on activity, content, topics, and trends in the world for commercial market research - all of which are pertinent to measuring online experiences. Major providers in this space are now also tailoring their tooling to meet government-specific analytical challenges, for example in data-driven government communications, counter-terrorism, or countering disinformation.

Malicious and economic harms measurement refers to a number of methodologies, commonly grouped into the category of 'safety tech', and has emerged in recent years in response to the growing presence of harmful behaviour online. The main focus of the safety tech market is on detecting harmful content, but an independent study for DCMS defines it more broadly as *'any organisation involved in developing technology or solutions to facilitate safer online experiences, and to protect users from harmful content, contact or conduct'*[3]. It is important to note that much of the tooling currently available in the safety tech market is not tuned for a research or analysis use case, but rather for other use cases such as automated content moderation.

User journey analytics is rooted in the advertising tech industry. The capability is designed to maximise conversion rates online by targeting consumers with tailored recommendations based on detailed persona insights and social graphs. The industry as a whole has a similar immediate need as Ofcom, to understand user experience, but with different overall goals - to convert into sales and to understand how site design can best support this. Approaches and tooling providers used in this space can help Ofcom measure online experience for market research purposes. It can also help understand how people are steered by platforms to specific content, potentially resulting in societal and / or economic harms.

Data science workflow underpinning this tooling

Utilising the automated tooling above typically involves four stages:



[3] https://www.gov.uk/government/publications/safer-technology-safer-users-the-uk-as-a-world-leader-in-safety-tech

Feasibility of open source data collection

We conducted primary research - via our own technical investigations and reviewing terms & conditions - to understand the feasibility of data collection via platform data APIs and web-scraping on a set of priority platform types. We did this for key exemplar platforms in each platform type, with the selection based broadly on those with highest usage. The table below summarises this research.

RAG rating:

Data available
Unclear / unspecified
Data not available / prohibited

		OPEN SOURCE DATA COLLECTION TECHNIQUES*		
		API research		Web scraping
		Data available via API (Y/N)	Available time period	Allowed by ToS (Y/N)
*Social video***	YouTube	Y	Unspecified	N
	Instagram	Hashtags and 'competitor' accounts	Unspecified	N
	Snapchat	N	N/A	N
	TikTok	N	N/A	N (commercial purposes)
	Vimeo	Y	Unspecified	Y (legal basis / approval required)
	Twitch	Y	Up to channel/user/video's lifetime	N
Social media	Facebook	Y	Unspecified	N
	Twitter	Y	Keyword search: past 7 days for free usage (further data requires payment)	Y (if Twitter approves)
Communications	WhatsApp	N	N/A	Unspecified
	Facebook Messenger	N	N/A	Unspecified
	Telegram	Y	User metadata retained for max.1 year, other data unspecified	Y
	Reddit	Y	Unspecified	Y (if Reddit approves)
	Rocket.Chat	N	N/A	N
	Kik	N	N/A	Unspecified
Ecommerce	Amazon	N	N/A	Y (if Amazon approve)
	Play Store	N	N/A	Unspecified
	Gumtree	N	N/A	Y (if Gumtree approve)
Gaming	PlayStation	Y	Playstation leaderboard API: going back to 2018 Playstation store API: unspecified	Unspecified
	Steam	Y	Going back to 2009	Unclear
	Apple App store	N	N/A	N
Streaming	Spotify	Y	Unspecified	N
	Netflix	Y	Unspecified	N
News	Google News	Y (via third party APIs - Webhose and News API)	Webhose: going back to 2008 News API: last 3 years	N
	Guardian	Y	Going back to 1999	Unspecified
	Financial Times	Y	Past 5 years	Y (if FT approve)
	Daily Mail	N	N/A	N
	BBC	N	N/A	Unspecified
Search	Google	Y	Going back to content publish date	N
	Google Trends	Y	Last 7 days for real time data Non-real time data can go back to 2004	N
	Yahoo	Y	Past month	Unspecified
	Bing	Y	Past year	Unspecified
	Bing Webmaster Tool	Y	Past 6 months	Unspecified

** Based on research carried out Jan-Feb 2021.*
***We are using the term 'social video' to reflect the broad range of platforms with video-sharing capabilities: this is without prejudice to whether the platforms meet the statutory definition of a VSP.*

Overall, the most comprehensive data APIs are provided by Twitter and Reddit, and these are commonly used by existing tooling providers. Other data APIs worth exploring include those for social video platforms, gaming, news and search. APIs for ecommerce are very limited, in which case web-scraping (with permission) could be an alternative solution. However, even for web-scraping, there is only a small selection of platforms that allow this, and it requires specific approval.

It is worth noting that many of the tooling providers on the market have agreements in place with specific platforms which allow them to provide greater data access than can be achieved by fully open-source collection.

4. Market assessment

In this section we summarise our assessment of how well the automated tooling market can support different research needs. Given the rapid pace of change in this sector, we also give a high-level assessment of the likely future developments and trends which could become relevant.

Example tooling providers by capability area

The below figure provides a summary of example tooling providers mapped to each of the defined capability areas. The tooling providers explored here are not meant to be exhaustive but rather representative of the market, and have been identified through desk research and external interviews with providers and academic bodies. It is worth stressing that the categorisation of tooling providers into the different market capability areas is necessarily subjective and represents Faculty's limited assessment, rather than being self-reported by the providers themselves. Furthermore, many of the providers listed offer services or tools across multiple capability categories, so we have only included them in a primary category in those cases.

Social media analytics	Social listening	Brandwatch, SocialBakers, Meltwater, Dataminr, Ripjar
	Community / network analysis	NetBase Quid, Audiense, Profiler
Malicious and economic harms measurement	Detecting harmful behaviour and content	CRISP, Moonshot, Factmata, Samurai Labs, TwoHat, Image Analyser, Unitary, Dragonflai
	Identifying false information / goods	Factmata, Yonder, Sensity AI, Full Fact
	Child-safe environments	Superawesome
	Verifying ages	Yoti, Trust Elevate, CAP Certified
	User-initiated protection	SafeToNet, Smoothwall, Gobubble, Netaware, Kryptowire
User journey analytics	Web traffic analytics	Alexa dashboards, Semrush
	Passive metering	Analysis from agencies
	Ad tech aggregators	Quantcast, Lotame, Datos, Tradedesk

Each category offers existing market solutions that are able to provide research insights into online experiences, and the specific abilities are explored later in this section.

However, it is worth highlighting that few of the tools on the market have been specifically designed to support organisations with understanding and regulating online environments: the closest that currently exist are social media analytics tools which have been tuned for government analysis needs. Whilst a tooling market has not yet been established for the specific purpose of regulating online environments, this may emerge in the next few years as a result of growing appointments of online regulatory bodies in not only the UK, but also the EU and internationally. Regulators and similar organisations may therefore be able to capitalise on global economies of scale as an increasing number of tooling providers develop tailored products for this need.

Where solutions are explored, there will need to be due diligence of these technologies, both in their approach to data collection and storage, and what weight to place upon analytical findings. These are not insignificant tasks. On the latter, it is important to interrogate model accuracy, especially for those that use machine learning techniques. Model validation can often be a lengthy and rigorous process, and a gold standard approach would involve third party (or in-house) validation on data that is completely unseen by the model.

Ability to measure different aspects of online experience by capability area

We provide an overview assessment of how the market capability areas are able to measure different aspects of online experience- in particular **coverage of users**, **coverage across specific online environments**, and specific **actions** in the Annex.

Measuring Coverage - users

Overall, tooling in most capability areas can provide a basic level of analysis on user demographics including age and gender. There may be some challenges with accessing this in relation to capabilities for malicious and economic harms measurement, particularly for data on younger age demographics, because the tooling providers in this space operate under 'privacy by design' principles. Demographic information will need to be collected in a proportionate way, and sufficiently anonymised.

In terms of other user characteristics, user journey analytics can provide the most granular level of detail through passive metering and ad tech aggregators that track individual user journeys and can create detailed personas. Both social media analytics and malicious and economic harms measurement are less granular, but can provide aggregate insights into certain types of users based on how they are behaving and what they are interacting with online.

Measuring Coverage - online environments

Overall, there is reasonable coverage of priority platform types and device types provided by existing tooling providers. Social media analytics offers coverage for device types and for social media, social video platforms and communication channels, but not e-commerce, gaming and news, although similar methodologies could be applied for these platform types. A similar situation also applies for malicious and economic harms measurement, with capability targeted more towards social media and communication platforms, and device type data not being something that is generally captured.

User journey analytics provide good coverage of device types and the most comprehensive coverage of platform types, as the methodologies are designed to be applied across all websites and apps that users come into contact with. Because of this, approaches within user journey analytics are often well suited to understanding economic competition issues including default bias and multihoming.

The distinction between signed-in and non-signed-in environments has not been explicitly highlighted because most platform types cover both of these in some format (for example both Twitter and Telegram can be accessed without requiring a login). However, the actions users can perform will differ depending on whether they are signed in or not.

Measurement of non-signed-in environments is easier, because this is information that tends to be publicly available and can therefore be accessed via data APIs or web-scraping techniques. There are a number of existing tooling providers that do this. Measuring signed-in environments is harder because platforms themselves own this data and its use is restricted under their terms of service.

Measuring Actions

For each category of user or online environment, there are then a number of in-depth questions that can be analysed along the **Usage**, **Interaction** and **Impact** dimensions.

Overall, measuring dimensions related to usage is most feasible. Social media analytics can provide a range of online activities and provide aggregated statistics on what users are doing. Similarly, malicious and economic harms measurement capability can identify categories of harmful content or behaviour that are being engaged with and report on this at an aggregate level.

User journey analytics tools can also report on which websites and apps users are visiting and associated engagement statistics. Interactions can also be measured with content rather than with people. Social media analytics tools are able to do this most successfully. Finally, impact is hardest to measure because it is hard to prove causation with these tools, but some inferences can be made if the right amount and quality of journey data is available.

Future trends and likelihood of realisation

Tooling capability, and in particular the underpinning data science techniques, are continuing to evolve as the market expands and new demands emerge from both industry and public bodies. Whilst many data science techniques that these tooling providers rely on have existed as concepts for years and are therefore not novel, what has brought them to the forefront of technology development is the drastic increase in compute power and data volumes that have become available over the past five years.

The majority of these future trends are focused on the **evolutionary** developments mentioned above. **Revolutionary** approaches that are radical departures from previous methods have been less observed in our horizon scanning.

Nevertheless, the market is evolving and expanding fast. Through our desk-based research and external interviews with academics and thought leaders, we have identified several future trends for how the market capability landscape is likely to evolve. This is summarised in the figure below:

RAG rating: Credible development in near future Possible but current development is limited Major limitations to realising potential		FUTURE TRENDS		
		Dataset curation (larger, higher quality datasets, privacy preserving tech)	**AI safety** (methods for explainability, fairness and robustness)	**Advanced machine learning** (new, more technically complex approaches)
Social media analytics	Social listening	New datasets being added to market leading social listening tools every year - although Facebook's move to encryption will further limit access to their products	Possible for tools to offer more explicit precision metrics on proxy data they provide using AI (for example sentiment analysis) but companies do not appear to be prioritising	More powerful NLP and multimodal ML combining text and visuals for more contextual analysis
	Community / network analysis			
Malicious and economic harms measurement	Detecting harmful behaviour and content	Early development of central platform to store / process harms data and develop shared taxonomy of online harm	Explainability / fairness are in early development stages but will become more important as these approaches are more widely used	Multimodal ML combining text and visuals for more contextual analysis / to identify more forms of harm
	Identifying false information / goods			
	Child-safe environments	Growth in initiatives encouraging parents to provide consent for using children's data for user testing / model training. Also development of age verification tech using non-PII data (e.g. gestures)		
	Verifying ages		Academic research ongoing into bias for age estimation tech	New technologies being developed (e.g. facial recognition, gesture and touch-based classification)
	User-initiated protection			Multimodal ML combining text and visuals for more contextual analysis / to identify more forms of harm
User journey analytics	Web traffic analytics	Development of privacy preserving tech as 3rd party cookies are phased out in 2022		
	Passive metering			Development of more powerful ACR technologies that enable more granular analysis of user behaviour
	Ad tech aggregators	Development of privacy preserving tech as 3rd party cookies are phased out in 2022	Stronger demand to develop AI fairness on ad tech models to ensure these do not make decisions based on biased data	Development of privacy preserving techniques to protect personal data

5. Key legal and ethical considerations

There are an important set of legal and ethical considerations associated with the use of such tooling, and organisations need to give care to how they are collecting, processing, and storing data, using anonymised data where possible.

Key legal considerations

The primary legal considerations that this project considered revolve around data collection and include GDPR, the Privacy and Electronic Communications Regulations (PECR), the Regulation of Investigatory Powers Act 2000 (RIPA), and platform terms of service. It is important to emphasise that the below legal considerations are not designed to be exhaustive.

GDPR and PECR

The use of such tooling needs to be compliant with GDPR and PECR, particularly when processing personal data. The means and purpose of the processing of such data must be 'specified, explicit and legitimate' (GDPR Art 5.1(b))m and compliant with obligations such as data minimisation and those that apply to special categories of data, such as data relating to political or religious views, sexual orientation (GDPR, Art 9) and data relating to children (GDPR, Recital 38).

Typically, public bodies using such tooling should look to carry out Data Protection Impact Assessments, both at the start of a specific data collection, or following significant changes in research scope.

Regulation of Investigatory Powers Act 2000 (RIPA)

The use of such tooling also needs to take into account the law around directed surveillance, as defined in RIPA. Directed surveillance is covert, non-intrusive collection of information on an individual or group. While this is rarely the intended outcome of such tooling, organisations should be careful when collecting data over time which can theoretically be combined to understand patterns of behaviour or develop profiles on individuals or groups.

It is therefore important for organisations using such tooling to understand what data they are collecting and how that data is being collected and stored, while undertaking analysis on online behaviours. Data collection and processing techniques can be deployed to support the collection of data on online behaviours that would not constitute directed surveillance, these include:

- Centring data collection (i.e. from an API) on topics and activities, rather than individuals or groups;
- Anonymising or pseudo-anonymising data as a first processing step (before data is stored);
- Aggregating data relating to specific user journeys, such that it would be impossible to identify any single user from the data.

Platform terms of service

Any data collection techniques applied to platforms (i.e. from an API or through web-scraping) must be compliant with the terms of service of the platform the data is being collected on. This legal consideration also applies to any tooling providers that collect data via APIs or web-scraping from platforms.

Other legal considerations will likely also apply, such as the Computer Misuse Act 1990 and the Human Rights Act 1998.

Further ethical considerations

There are a further range of ethical principles which should be considered when using such tools, particularly when used by public bodies. A fuller review of key ethical considerations was carried out for Ofcom, but key ones which have wide applicability include:

- **Privacy:** Ethically, organisations will typically want to go further than solely the legal considerations above in respect of processing public data to preserve privacy. Measures include aggregating data and introducing steps to ensure that organisations are only collecting the minimum data required for the research question they are seeking to address. In many cases this will require data and metadata being specifically stripped out of datasets in a pre-processing step before this data is aggregated.

- **Miscommunication, misleadingness and misinterpretation:** There are a range of biases that affect both the data collected, the tools and methodologies that can be deployed on that data to determine specific user groups and behaviours. And whilst AI can support the segmentation of aggregated data into specific community or demographic profiles, these approaches should be regarded as proxies, not precise representations. It is important therefore not only to set out the limitations when presenting research findings, but also to upskill research teams in use and interpretation of data and these methods.

- **Consent:** A number of existing tooling providers rely on the consent of users in order to process their data for further analysis, for example through consent for the use of cookie data. However, there are potential ethical issues with this if users are not aware of what they have consented to. For example, some tooling providers covered in this report operate on the premise of 'Opt-out' models, whereby users are automatically opted in for data sharing as part of the terms of using the service, but may not be fully aware of this.

- **Explainability:** Explainable AI is a growing trend in the field of AI[4], and encompasses a range of approaches for providing "explanations" for model outputs that are understandable by humans, even for black-box modelling techniques. The ability to explain the rationale for algorithmic decision-making is becoming increasingly important for organisations looking to adopt data science techniques at scale. Organisations using automated tooling should ensure that, where algorithms are used as part of tools (such as to infer user sentiment, to develop proxy socioeconomic characteristics, or to make predictions), these algorithms and their limitations are explainable and understood by human analysts.

- **Transparency:** When organisations intend to use mass data collection for research use, it is recommended to make the details and intended outcomes of that research transparent, to help build public confidence for the use of such tooling. Furthermore, where a specific data request is to made to a platform or a specific account is required to make use of their APIs (as most do), it is recommended that these are created under the organisation's name, if possible with an explanation of the research that it is intending to undertake.

- **Fairness:** Self-selection bias is prominent in web traffic analytics and some categories of malicious and economic harm measurements. With this, bias exists early on in data collection and is much harder to deal with. Other forms of bias exist in proxy measurements, where some approaches use behaviours to estimate age, and names to estimate gender. Organisations using such tooling should therefore seek reassurances on how potential biases are reviewed, overcome, and documented; and depending on the intended use case may also want to develop a plan for overcoming key biases.

In summary, the power of automated tooling - its ability to collect and analyse very large scale data on people's online experiences - does create important legal and ethical considerations, but these can be managed so long as organisations take care in doing so.

[4] https://www.gartner.com/smarterwithgartner/top-trends-on-the-gartner-hype-cycle-for-artificial-intelligence-2019/

Annex Market capability assessments

The below tables give an overview assessment of how the market capability areas are able to measure different aspects of online experience- in particular **coverage of users**, **coverage across specific online environments**, and specific **actions:**

Measuring Coverage - users

RAG rating: No barriers to measurement Some barriers to measurement Significant barriers to measurement		**COVERAGE - USERS**			
		Common demographics			**Other user characteristics (e.g. vulnerabilities, behaviours, interests etc.)**
		Age	Gender	Location	
Social media analytics	Social listening	Most providers will supply this or offer approximations (the precision of which vary) - people often state location and occasionally state age and gender in social media profile metadata.			Does not cover vulnerabilities - would have to create a proxy to measure. Often offer data on behaviours and interests.
	Community / network analysis				Advantage in segmenting populations Opportunity to discover new segments
Malicious and economic harms measurement	Detecting harmful behaviour and content	Aggregate insights on demographics			Aggregate insights on types of harmful user behaviours
	Identifying false information / goods	Approximations			Aggregate insights on types of users spreading false information (based on topical interests, ideologies etc.),
	Child-safe environments	Do not collect data on user demographics or behaviours as part of zero data policy / privacy by design principles			
	Verifying ages	Would require permission from platforms to access this data			
	User-initiated protection	Would require permission from platforms / tooling providers to access this data			
User journey analytics	Web traffic analytics	Approximations		Accurate - city level	Does not collect other demographic information
	Passive metering	Voluntarily provided with consent			
	Ad tech aggregators	Approximations		Accurate - city level	Ad tech value proposition is being able to create detailed personas for more targeted advertising

Measuring Coverage - online environments

RAG rating:

Possible with existing tooling
Possible with in-house methods
Not possible due to major barriers
Irrelevant

		COVERAGE - ONLINE ENVIRONMENTS									
		Platform types								**Device types**	
		Social video	Social media	Comms	Blogs / forums	E-comm.	Gaming	News	Search	Mobile	Desktop
Social media analytics	Social listening										
	Community / network analysis										
Malicious and economic harms measurement	Detecting harmful behaviour and content										
	Identifying false information / goods										
	Child-safe environments										
	Verifying ages										
	User-initiated protection										
User journey analytics	Web traffic analytics										
	Passive metering										
	Ad tech aggregators										

RAG rating:

No barriers to measurement Some barriers to measurement Significant barriers to measurement		**ACTIONS**		
		Usage Broad online usage	**Interaction** What users encounter	**Impact*** How users are affected
Social media analytics	Social listening	Can monitor a range of online activity over time	Can track person to person interactions - harder to track likes / shares	Can be used to collect data indicative of changing attitudes and behaviours
	Community / network analysis	Provides activity type / frequency at aggregate level - without user-specific detail	Network analysis inherently measures contact points, again without specific detail	Segments will shift if behaviour changes which makes it hard to compare
Malicious and economic harms measurement	Detecting harmful behaviour and content	Can identify categories of harmful behaviour and changes over time	Can identify groups / channels associated with harm that users are joining. Tools track harmful language between users	Can predict spread of harmful behaviour, but not impact on individual users
	Identifying false information / goods	Can identify topics of false information, associated sentiment, and analyse spread over time	Can analyse levels of engagement with false information, and top users promoting this	Can predict spread of misinformation over time, but not impact on individual users
	Child-safe environments	Aggregate statistics on usage of child-safe environments - limited detail; permission required	Do not track person to person interactions	Does not address impact on its own (although could be compared with non child-safe platforms)
	Verifying ages	Could only provide aggregate statistics on number of users verified; permission required	Do not track person to person interactions	Does not address impact on its own (although could be compared with platforms that do not age-gate)
	User-initiated protection	Aggregate statistics on type of content viewed / blocked; permission required	Aggregated insights on risk of harmful interactions	Does not address impact on its own (although could be compared with users that do not employ protection tools)
User journey analytics	Web traffic analytics	Will provide a view on broader internet use and with specific websites	Does not provide a view on interactions with people or content	Does not provide a view on impact
	Passive metering	Can track usage of apps and websites	Limited to videos, ads, and consumer goods - no person to person interactions	Some potential with individual measurements + interaction measurements
	Ad tech aggregators	Can track usage of websites on desktop web-browsing	Limited to interactions that can be measured through URL information	With full browsing history, impact of previous journey can be deduced

* For impact measurements, correlations are measured - it is hard to prove causation with these approaches