

algo:aware series

An overview of the Programmatic Advertising Ecosystem: Opportunities and Challenges

Procured by the European Commission's Directorate-General for Communications Networks, Content and Technology

Case Study#1 | Version 0.7

June 2019

Table of Contents

Executive Summary	4
1. Introduction	8
1.1 Programmatic advertising overview	8
1.2 Real-time bidding overview.....	9
1.3 Real-time bidding overview.....	10
Other forms of programmatic advertising	11
1.4.....	11
1.5 Real-time bidding process	11
1.6 How do advertisers use algorithms in the RTB process?	13
2. User data and consumer profiling in the programmatic advertising ecosystem	15
2.1 Analysis of data use in the programmatic advertising ecosystem.....	16
2.2 Mobile-web advertising vs. application advertising.....	17
Economic Overview of the Programmatic Advertising Ecosystem	20
2.3 Programmatic advertising	21
2.4 Key players in the programmatic advertising ecosystem	24
2.5 Publisher effectiveness in the ecosystem.....	26
2.6 Ad Fraud in the programmatic ecosystem.....	27
2.7 Verification and measurement guidelines and standards	29
3. Impact of GDPR on Programmatic Advertising	32
4. Policy-relevant questions and wider Societal Effects of Programmatic Advertising	35
4.1 Programmatic advertising: transparency of the ecosystem to consumers	35
4.2 Programmatic advertising: transparency of ad exchanges and ad placements.....	36
4.3 Programmatic advertising: civic engagement	36
4.4 Programmatic advertising: news consumption	38
4.5 Programmatic advertising: discrimination in automated job advertising.....	39
4.6 Evidence of job advertising discrimination in the programmatic advertising ecosystem	41
5. Conclusions	43

Executive Summary

This case study offers an overview of programmatic advertising, presents the technology and functioning of the process, and describes the main market trends, as well as a series of policy concerns flagged in the literature, including: data protection concerns¹; transparency and brand safety concerns²; the prevalence of advertising fraud which leads to decreased effectiveness for advertisers as well as lost revenues for publishers³; the propagation of discriminatory practices due to systemic biases; the propagation of ‘fake news’ that especially intends to influence the outcome of democratic elections⁴; and political advertising on platforms that are not currently covered by electoral law⁵.

The case study has been developed with design thinking principles, through a combination of desk research, interviews and written feedback with stakeholders from academia, industry and public policy. Intermediate findings were tested and validated with a workshop held at DG Connect before further analysis and final synthesis.

Traditionally, advertising space was sought after in outlets and news brands that were thought to be suitable for an advertiser’s target audience – this is of course still true in the digital advertising space, but technological solutions are offering more granular audience targeting possibilities.

Programmatic advertisement can be described as **the use of software and automation to buy and sell digital advertising**. In contrast to traditional methods that include requests for proposals, tenders, quotes and human negotiation, programmatic advertising utilises algorithms to purchase display space automatically, using data to determine which spaces to buy, how much to pay and who to target.

There are several models of programmatic advertising, including:

Real-time bidding (RTB) - a subset of programmatic advertising that facilitates the buying and selling of *ad inventories*⁶ via an auction that occurs in the time it takes for a webpage to load. RTB occurs on a digital exchange (such as OpenRTB exchanges), which allows the transaction between the advertisers (demand side) and publishers (supply side) to occur in real-time and is relevant for search, display and video advertising content across desktops and mobile. There are several distinct functions in the programmatic advertising value chain, all of which intervene in real-time bidding models, but might be present, to a different extent, also in other advertising models:

- The **Publisher** in the context of the digital advertising ecosystem is a website or application that has a revenue stream through displaying adverts when visited by a user. The space that publishers make available to display adverts (ad space) is known as the publisher’s **inventory**. By this broad definition, a publisher may be anything from a news outlet to a blog page, to a mobile app (in digital display advertising models), a social media website (most often also handling itself the ad placing process), or an online search engine.⁷

¹ EDPS, “EDPS Opinion on Online Manipulation and Personal Data,” accessed July 26, 2018, https://edps.europa.eu/sites/edp/files/publication/18-03-19_online_manipulation_en.pdf.

² “Ad Fraud & Brand Safety Remain the Biggest Programmatic Issues Say DTA USA Judges,” The Drum, accessed February 26, 2019, <https://www.thedrum.com/news/2018/08/07/ad-fraud-brand-safety-remain-the-biggest-programmatic-issues-say-dta-usa-judges>.

³ Lucinda Southern, “The Fight against Ad Fraud in 4 Charts,” *Digiday* (blog), March 14, 2018, <https://digiday.com/media/fight-ad-fraud-4-charts/>.

⁴ EDPS, “EDPS Opinion on Online Manipulation and Personal Data.”

⁵ Katharine Dommett and Luke Temple, “Digital Campaigning: The Rise of Facebook and Satellite Campaigns,” *Parliamentary Affairs* 71, no. suppl_1 (March 1, 2018): 189–202, <https://doi.org/10.1093/pa/gsx056>.

⁶ Advertising inventory is the number of advertisements, or amount of ad space, a publisher has available to sell to an advertiser

⁷ Publishers may also make their inventory available to an ad network, a broker between the advertisers and publishers, via the publisher’s ad server. The ad network collates inventory from several publishers and the advertiser’s ad server purchases inventory from the ad network.

- The **Supply-Side Platform (SSP)** helps publishers to manage/sell their inventory on a number of ad exchanges in an automated manner. It analyses the information of the user and sends it to the exchange to maximise the price that publishers can receive for their impressions.
- The **Ad Exchange** acts as an online marketplace that allows advertisers (buyers) and publishers (sellers) to buy and sell online inventory. It does so by auctioning impressions to the highest bidder.
- The **Demand-Side Platform (DSP)** is the advertisers' equivalent of the supply side platform. It enables advertisers to store their adverts, or creatives, and allows them to track metrics and set the buying parameters for their campaigns. Here, the DSP uses algorithms to determine the 'value' of the user based on the target audience selected for the advertisers campaign, before placing a bid in the auction for the **impression** if appropriate.
- **Advertisers**, both commercial and non-commercial, create advertisements to promote their goods and services. This is often done using an **Ad Agency**.

Private Marketplace (PMP) - is an 'invitation only' RTB auction where one, or a select few, publishers invite select pre-approved buyers to bid on their inventory. Here, the DSP plugs directly into the source of the publisher's inventory, which eliminates the requirement for an exchange and the buyer is aware of exactly where the advert will run. Advertisers may use private marketplaces to obtain 'premium' placements in conjunction with bidding on the open ad exchange.

Programmatic Direct - is a non-auction-based approach that allows advertisers to buy guaranteed ad impressions in advance from specific publisher sites. Programmatic direct arguably offers the value of increased transparency, which is a cited issue with RTB, and there are two forms of programmatic direct. **Programmatic Guaranteed** is a predetermined commitment from advertisers to buy a fixed amount of inventory for a fixed cost per thousand views or clicks (cost per millie – CPM)⁸ from specific publisher sites. Publishers may be more inclined to sell top-tier inventory like home-page takeover ads at a fixed price for a guaranteed number of impressions. **Preferred Deal** is a predetermined commitment to inventory price but not inventory amount between one buyer and one seller.

The digital advertising market is proving to be extremely dynamic and growing quickly. Gross digital advertising expenditure in Europe totalled €48.0 billion in 2017, up 13.2% from €42.5 billion in 2016 and the market has doubled in size over the past 5 years⁹. Czech Republic, Slovenia and Sweden all experienced over 18% of growth in 2017, exemplifying the high rate of growth in the Central and Eastern Europe and Nordic Markets. In the UK, the spend on digital out-of-home advertising is set to overtake classic billboard advertising¹⁰. Furthermore, this growth is driven by the growth of digital mediums; it is projected that the total global investment on digital media is projected to be within a range of \$400 billion to \$500 billion by 2025.¹¹

The European Programmatic Market Sizing Report joint-produced by IAB Europe and IHS Markit reveals that the total programmatic display advertising market in Europe experienced a year of double-digit growth jumping 27.1% to €12bn in 2017.¹² Programmatic revenues were €10.8bn Western Europe and €1.2 in Central and Eastern Europe, highlighting the different rate of growth between different European markets.

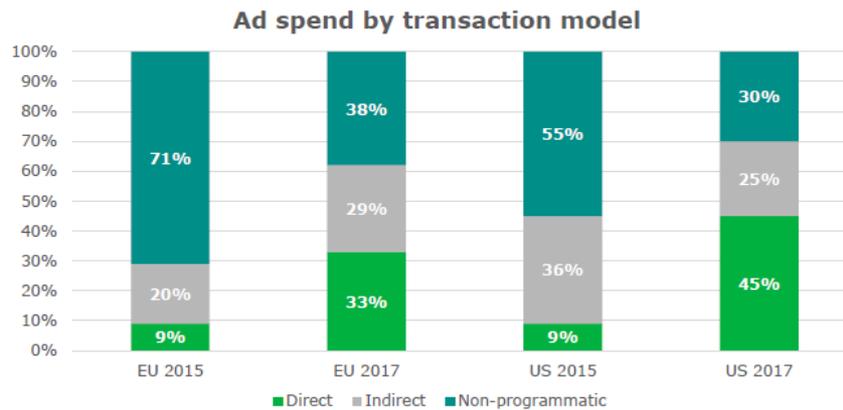
⁸ This can be views or clicks depending on the nature of the deal between the buyers and seller

⁹ IAB Europe and IHS Markit Report – AdEx Benchmark 2017

¹⁰ "Google's Targeted Ads Are Coming to a Billboard Near You - Bloomberg," accessed February 27, 2019, <https://www.bloomberg.com/opinion/articles/2018-08-10/google-s-targeted-ads-are-coming-to-a-billboard-near-you>.

¹¹ Based on historical trends from GroupM and ZenithOptimedia, plus WFA projections based on future market forces

¹² IAB Europe Report: European Programmatic Market Sizing 2017



© 2019 IHS Markit. All Rights Reserved.

Source: IHS Markit, Advertising Intelligence, C

In the US, in 2018, 54% of RTB is expected to occur on the open exchange, whilst private marketplaces – including ads transacted through an invitation-only RTB auction where one publisher or a select group of publishers invite a select number of buyers to bid on its inventory – will account for the remaining 46%. RTB advertising spend transacted on private marketplaces is expected to surpass the advertising spend on the open exchange in 2019. This shift to private marketplaces is primarily being driven by shifting attitudes and behaviours in advertisers who are: seeking to increase spend on verifiably brand safe channels ; demanding transparency from agencies and suppliers; increasing spend with premium content publishers.

In 2017, Google and Facebook accounted for 33.0% and 16.2% of digital ad revenue share worldwide, respectively¹³. Given that together they account for such a high proportion of online advertising revenue, this case study also focuses on how Google and Facebook operate in relation to the rest of the online advertising ecosystem.

One of the reasons for the large market share of these two companies is that they **occupy several positions across the digital advertising supply chain**. They provide popular online services where they collect **user data**. This data can be combined with data from additional sources to profile users, thereby allowing advertisers to target a specific audience. They also both **operate ad exchanges** to connect advertiser’s content with publisher inventory, as well as supply and demand side platforms. Finally, they have **ad space on their own platforms** where they are able to serve impressions to users.

DSPs, typically managed by in-house marketing teams, advertising agencies, or agency trading desks that specialize in real-time advertising, are a key point in the advertising chain where algorithms are used to maximise value to advertisers (e.g. maximise the number of views or clicks depending on the advertisers’ strategy). In the ad exchange, the bidding process is automated and therefore algorithms are preconfigured by humans to bid appropriately according to the pre-defined advertising strategy. Advertisers on both open and private marketplaces claim that they require granular data each user at the level of a specific audience segment to ensure that they are bidding to place their creatives in front of their desired target audience. Consequently, the algorithms programmed in the DSP are configured to bid for impressions depending on user device and location, cookie ID, historical data and overlaid

¹³ “Net Digital Ad Revenue Share Worldwide, by Company, 2016-2019 (% of Total and Billions) - EMarketer,” accessed February 28, 2019, <https://www.emarketer.com/Chart/Net-Digital-Ad-Revenue-Share-Worldwide-by-Company-2016-2019-of-total-billions/205364>.

with third-party user information from **data management platforms (DMPs)**¹⁴ to try and optimise the audience targeting capability.

The programmatic advertising ecosystem is currently predicated on the premise that to reap the apparent advantages of programmatic advertising and real-time bidding, marketers need to understand demographics and behaviours of their potential customers, and then categorise them accordingly to serve them the most appropriate content. For this, advertisers utilise both online and offline data from three main sources:

- **First-party data** is the advertiser’s own data on their customers. It includes data on behaviours, actions or interests collected from across the advertiser’s website(s), app(s), social media and subscriptions.
- **Second-party data** is collected by someone other than the advertiser, an agency for example, who shares that data with the organisation to help develop the advertising strategy. The data is shared to the mutual benefit of the organisations and is not publicly available.
- **Third-party data** is available to anyone at a cost and usually sold by data brokers – who are not the original collectors of the data. The data brokers aggregate the data from other websites and publishers to form large datasets

With this in mind, Andreou *et al.* conducted experiments where the authors created their own adverts and mapped user preferences to the explanations that were provided to investigate the level of transparency that these methods genuinely provided in practice. The authors conclude that the “ad explanations feature is often incomplete and sometimes misleading while data explanations are often incomplete and vague.” Moreover, the authors argue that “malicious advertisers may be able to obfuscate their true targeting attributes by hiding rare (and potentially sensitive) attributes by also selecting very common ones”. The authors have developed a tool called AdAnalyst that works in the browser when Facebook is open and provides additional explanations including some of the missing properties in a bid to move towards greater transparency.

AdFisher is another tool, developed by Datta *et al.* in their investigation into how user behaviour, either directly with browser settings or with content providers, alters the advertisements displayed to the user and whether these changes are aligned on Google Ad Settings.¹⁵ For example, they found that setting the browser profile gender to female resulted in fewer instances of ads related to high paying jobs being displayed compared to when the gender was set to male. However, they were unable to determine the cause of these findings due to their limited visibility into the ad ecosystem, which includes Google, advertisers and websites. **The results of the experiment raise questions regarding transparency, fairness and accountability of the data and algorithms used to serve the advertisements.**

¹⁴ A **data management platform (DMP)** is a unifying platform to collect, integrate, analyse first-, second- and third-party audience data from any source, including online, offline, mobile. The data stored and organised on DMP platforms is used for targeting selected audience groups in online campaigns

¹⁵ Amit Datta, Michael Carl Tschantz, and Anupam Datta, “Automated Experiments on Ad Privacy Settings,” *Proceedings on Privacy Enhancing Technologies* 2015, no. 1 (April 1, 2015): 92–112, <https://doi.org/10.1515/popets-2015-0007>.

1. Introduction

Programmatic advertisement can be described as **the use of software and automation to buy and sell digital advertising**. In contrast to traditional methods that include requests for proposals, tenders, quotes and human negotiation, programmatic advertising utilises algorithms to purchase display space automatically, using data to determine which spaces to buy, how much to pay and who to target.

It has been described by as a mechanism that allows advertisers to have more control over the scale of their campaigns and also enables them to tailor their creative content to individuals from specific demographics based on behavioural characteristics. The programmatic advertising ecosystem allows advertisers to purchase *impressions*¹⁶ in real-time from multiple publishers, that are targeted at a particular audience segment, rather than a fixed number of impressions from one publisher at once. The perceived benefit for both advertisers and publishers of programmatic advertising is exemplified by an increased global spend; between 20-50% in the France, Germany, UK, US and China in 2017¹⁷.

Despite this, a number of issues related to the current programmatic advertising ecosystem have been raised. These issues include but are not limited to data protection concerns¹⁸; transparency and brand safety concerns¹⁹; the prevalence of advertising fraud which leads to decreased effectiveness for advertisers as well as lost revenues for publishers²⁰; the propagation of discriminatory practices due to systemic biases; the propagation of ‘fake news’ that especially intends to influence the outcome of democratic elections²¹; and political advertising on platforms that are not currently covered by electoral law²².

This case study provides an overview of the programmatic advertising ecosystem highlighting some key areas of interest and explores current and emerging policy approaches on an industry, national, EU and global level. It aims to outline some opportunities and challenges regarding the use of the algorithms within the programmatic advertising ecosystem itself, but also the impact, if any, that the rapidly emerging form of digital advertising is having on society.

1.1 Programmatic advertising overview

Traditionally, advertising space was sought after in outlets and news brands that were thought to be suitable for an advertiser’s target audience – this is of course still true in the digital advertising space. Programmatic advertising is the automated form of ad buying in digital space.

The traditional process of manual media buying involved setting up campaigns in the advertiser’s ad server and then the ad codes were delivered to the publisher (for example via email). The Ad Ops team on the publisher’s side placed the codes in the publisher’s ad server and then the campaign started. In

¹⁶ An *impression*, sometimes called a view or an ad view, is a term that refers to the point in which an ad is viewed once by a visitor, or displayed once on a web page. The number of impressions of a particular advertisement is determined by the number of times the particular page is located and loaded.

The Interactive Advertising Bureau’s (IAB) technical definition of an *impression* is “a measurement of responses from a web server to a page request from the user browser, which is filtered from robotic activity and error codes, and is recorded at a point as close as possible to opportunity to see the page by the user”

¹⁷ emarketer.com

¹⁸ EDPS, “EDPS Opinion on Online Manipulation and Personal Data.”

¹⁹ “Ad Fraud & Brand Safety Remain the Biggest Programmatic Issues Say DTA USA Judges.”

²⁰ Southern, “The Fight against Ad Fraud in 4 Charts.”

²¹ EDPS, “EDPS Opinion on Online Manipulation and Personal Data.”

²² Dommett and Temple, “Digital Campaigning.”

this respect, programmatic advertising enables advertisers and publishers to reduce the time it takes to set up, run, and optimize their media campaigns.

Real-time bidding (RTB) is a subset of programmatic advertising that facilitates the buying and selling of *ad inventories*²³ via an auction that occurs in the time it takes for a webpage to load. RTB occurs on a digital exchange, which allows the transaction between the advertisers (demand side) and publishers (supply side) to occur in real-time and is relevant for search, display and video advertising content across desktops and mobile.

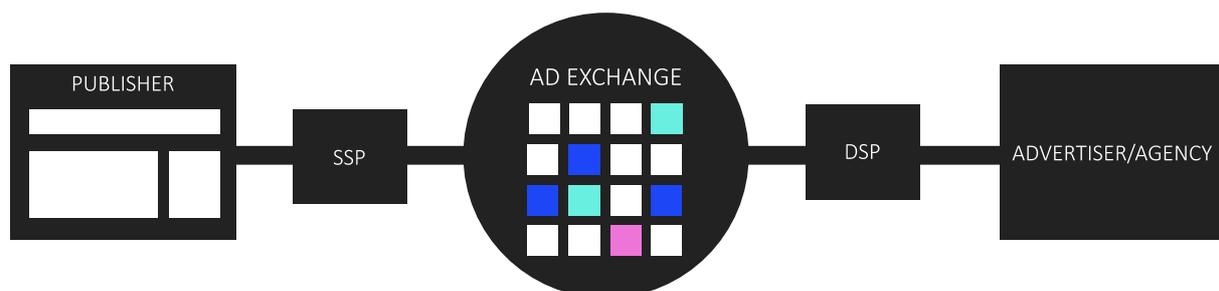
The primary perceived benefit of RTB is that it enables advertisers to place a greater emphasis on the number of clicks and/or views (*impressions*) that an advertisement is likely to receive from its target demographic. It enables marketers to purchase cheap inventory across a wider range of websites as opposed to simply purchasing advertising space from ‘premium’ sites. Through tracking across multiple devices, RTB ostensibly enables advertisers to have greater control of targeting individuals that they perceive to have the most value – buying advertising space per impression rather than in bulk for a fixed price. Marketers can then quantify how much has been spent on a targeted individual that has been converted (e.g. purchased a product).

For publishers, it is argued that RTB enables them to maximise the sale of all of their available advertising space for the maximum available value, therefore providing an opportunity to maximise revenue²⁴.

1.2 Real-time bidding overview

The bidding process in a public auction or open marketplace utilises OpenRTB, a protocol and API specification established by the Interactive Advertising Bureau Technology Laboratory (IAB).²⁵ The RTB supply chain involves numerous players across the digital advertising ecosystem. This initial introduction to RTB focuses on the relationship between five principal parties (Figure 1):

Figure 1: Overview of RTB parties



- The **Publisher** in the context of the digital advertising ecosystem is a website or application that has a revenue stream through displaying adverts when visited by a user. The space that publishers make available to display adverts (ad space) is known as the publisher’s **inventory**.

²³ Advertising inventory is the number of advertisements, or amount of ad space, a publisher has available to sell to an advertiser

²⁴ Ben Davis, “Six Advantages of Real-Time Bidding for Publishers,” Econsultancy (blog), February 1, 2016, <https://econsultancy.com/six-advantages-of-real-time-bidding-for-publishers/>.

²⁵ Originally established in 2010, the most recent OpenRTB protocol, 3.0, was established in November 2018 <https://www.iab.com/guidelines/real-time-bidding-rtb-project/>. The OpenRTB Working Group contains members from many of the major industry players in the digital advertising supply chain <https://iabtechlab.com/working-groups/openrtb-working-group/>

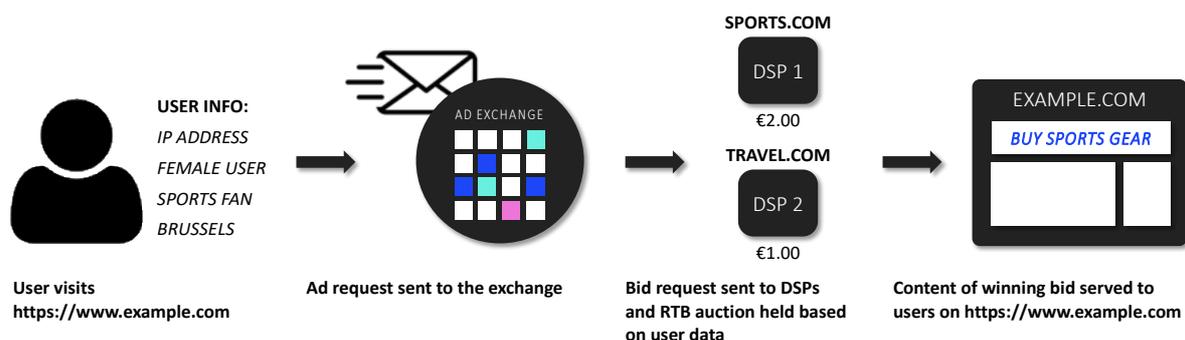
By this broad definition, a publisher may be anything from a news outlet to a blog page, and also includes sites such as Facebook and Google.²⁶

- The **Supply-Side Platform (SSP)** helps publishers to manage/sell their inventory on a number of ad exchanges in an automated manner. It analyses the information of the user and sends it to the exchange to maximise the price that publishers can receive for their impressions.
- The **Ad Exchange** acts as an online marketplace that allows advertisers (buyers) and publishers (sellers) to buy and sell online inventory. It does so by auctioning impressions to the highest bidder.
- The **Demand-Side Platform (DSP)** is the advertisers equivalent of the supply side platform. It enables advertisers to store their adverts, or creatives, and allows them to track metrics and set the buying parameters for their campaigns. Here, the DSP uses algorithms to determine the 'value' of the user based on the target audience selected for the advertisers campaign, before placing a bid in the auction for the **impression** if appropriate.
- **Data management platform (DMP)** allows advertisers to collect and manage user data from different sources in one location. Advertisers use the data management platform to create audience segments to facilitate ad targeting, profile users and infer interests based on user data, and analyse data to indicate the success of an ongoing advertising campaigns (*DMP not displayed in the diagram above*).
- **Advertisers**, both commercial and non-commercial, create advertisements to promote their goods and services. This is often done using an **Ad Agency**.

1.3 Real-time bidding overview

Real-time bidding enables the buying and selling of ad inventory on a per-impression basis through a real-time auction. It is so-named because the whole process occurs within approximately 100 milliseconds (Figure 2). The process begins when:

Figure 2: Overview of RTB process



- A **user** visits a webpage. As the publisher's webpage begins to load in the web browser, this initiates the loading of an ad impression.
- A request is sent to the **open ad exchange** via the **SSP** indicating that an impression is available. This request includes the website URL and may also include user data such as device, location,

²⁶ Publishers may also make their inventory available to an ad network, a broker between the advertisers and publishers, via the publisher's ad server. The ad network collates inventory from several publishers and the advertiser's ad server purchases inventory from the ad network.

browser history from cookies that may indicate gender, age, interests, behaviours and other useful information.

- The **open ad exchange** submits a bid request along with the accompanying data to multiple bidders (**agency trading desks**, using **DSPs** or proprietary technology, which collect bids from their advertisers).
- Based on the information contained in the bid request, **DSPs** automatically bid in real-time, according to user data, marketer’s targeting and budget rules set beforehand, to have their advert served to the **user**.
- The highest bidder wins the ad impression, delivers the advert and pays \$0.01 more than the second-highest bid – a second-price auction.
- The **ad exchange** sends the winning ad URL and price to the **publisher’s** ad server, which then tells the **user’s** web browser what to display.
- The creative is served to the **user** in the browser

1.4 Other forms of programmatic advertising

There are also exist other types of programmatic advertising that can be used in combination with, or independently of OpenRTB exchanges.

A **Private Marketplace (PMP)** is an ‘invitation only’ RTB auction where one, or a select few, publishers invite select pre-approved buyers to bid on their inventory. Here, the DSP plugs directly into the source of the publisher’s inventory, which eliminates the requirement for an exchange and the buyer is aware of exactly where the advert will run. Advertisers may use private marketplaces to obtain ‘premium’ placements in conjunction with bidding on the open ad exchange.

Programmatic Direct is a non-auction-based approach that allows advertisers to buy guaranteed ad impressions in advance from specific publisher sites. Programmatic direct arguably offers the value of increased transparency, which is a cited issue with RTB, and there are two forms of programmatic direct. **Programmatic Guaranteed** is a predetermined commitment from advertisers to buy a fixed amount of inventory for a fixed cost per thousand views or clicks (cost per millie – CPM)²⁷ from specific publisher sites. Publishers may be more inclined to sell top-tier inventory like home-page takeover ads at a fixed price for a guaranteed number of impressions. **Preferred Deal** is a predetermined commitment to inventory price but not inventory amount between one buyer and one seller.

Finally, some platforms that display advertisements and operate their own exchanges have unique bidding processes. For example, Facebook utilises ‘Facebook Ads’ to deliver advertisements. A Facebook Ads auction operates a ‘highest total value’ bidding system which considers the advertiser bid strategy, an estimate of a user taking an action, and how relevant the advert is to a particular user to determine who is the winner of the auction. These processes are discussed further below.

1.5 Real-time bidding process

The OpenRTB protocol is used by the majority of companies in the online media and advertising industry.²⁸ The market-leading ad exchange is the Google-owned ‘Authorized Buyers’ - recently

²⁷ This can be views or clicks depending on the nature of the deal between the buyers and seller

²⁸ Other major ad exchanges include One by AOL (owned by Verizon). AppNexus (owned by AT&T), Rubicon Project. TrustX is recently established private marketplace launched with the intention of promoting trust and transparency between authorised advertisers and publishers.

rebranded from 'DoubleClick Ad Exchange (AdX)'. Other prominent ad exchanges include AppNexus and Rubicon Project, which together with Authorised Buyers (DoubleClick) have an 83% share of the ad exchange market.²⁹

Open RTB and Authorized Buyers specification documents reveal that user's data is broadcast to, at times, hundreds of companies as part of the bid request.³⁰ Below is a sample of user data that is broadcast every time a user loads a page that utilises real-time bidding³¹:

- What the user is reading or watching.
- The user's location (longitude and latitude [geolocation])
- Description of the user's device.
- Unique tracking IDs or a "cookie match" that allows advertising technology companies to try and identify the user the next time they are seen, so that a long-term profile can be built or consolidated with offline data about them.
- The user's IP address (depending on the version of "RTB" system).
- A data broker segment ID, if available. This ID may denote user income bracket, age and gender, habits, social media influence, ethnicity, sexual orientation, religion, political leaning, etc. (depending on the version of "RTB" system).

Google's Authorised Buyers real time bidding auction functions much in the same way as the OpenRTB auctions described above (the standard protocol for online advertising auctions). The Google Authorised Buyers platform enables advertisers to participate in both open and private auctions, whilst also enabling the integration of OpenRTB auctions. Both auctions function as second price auctions where the highest bidder pays the price bid by the second-highest bidder.

In contrast, Facebook utilises 'Facebook Ads' to deliver advertisements. A Facebook Ads auction operates a 'highest total value' bidding system which considers three distinct factors to determine who is the winner of the auction:

- **Bid** – Facebook Ads will consider the bid strategy that an advertiser has decided to employ and automatically bid a cost per *optimisation event*³². Advertisers can set bid caps and cost targets to guide Facebook's automatic bidding process.
- **Estimated action rates** – This is the likelihood that Facebook believe that a user will take an action based on what the advertiser is optimising for. This is based on estimates of the previous actions of the targeted user and the historical performance data of the advert.
- **Ad quality and relevance** – Facebook Ads relevance score is calculated by weighing positive interaction with advertisements (such as likes, comments, shares, and clicks) against negative interactions (like users hiding the ads or leaving negative comments). For example, if an advertisement has received negative feedback, that can decrease its total value.

The above factors are standardised to account for different *optimization events* and then combined into a total value. The ad with the highest total value wins the auction and gets shown. Total value

²⁹ Market share of prominent ad exchanges: DoubleClick, 63%; AppNexus, 12%; Rubicon Project, 8%. <https://www.datanyze.com/market-share/ad-exchanges/Datanyze%20Universe/>

³⁰ The OpenRTB specification documents: <https://www.iab.com/wp-content/uploads/2016/03/OpenRTB-APISpecification-Version-2-4-FINAL.pdf>

IAB TechLab (<https://iabtechlab.com/>) - The IAB is the standards body and trade lobby group of the global advertising technology industry. All significant ad tech companies are members. The IAB has local franchises across the globe. Its standards-setting organisation is IAB TechLab.

³¹ A complete summary of the of the personal data in OpenRTB and Google's proprietary bid request can be found in Appendix 1 and Appendix 2 respectively, of "Report from Dr Johnny Ryan – Behavioural advertising and personal data" <https://brave.com/Behavioural-advertising-and-personal-data.pdf>

³² An "Optimisation for Ad Delivery" choice for an ad set is one where the buyer specifies to Facebook to optimise as many/much as possible for that result, as efficiently as possible. For example, the buyer might decide to optimise the ad campaign for impressions, clicks, conversions, daily unique views, post engagement, brand awareness, leads, landing page views etc..

determines who wins an auction, but not when or how much the winner is charged. Advertisers are charged when the result they have chosen to be charged for during ad set creation occurs. The amount charged is the minimum amount that Facebook would have needed to set the Advertiser's bid to win the auction.

1.6 How do advertisers use algorithms in the RTB process?

DSPs, typically managed by in-house marketing teams, advertising agencies, or agency trading desks that specialize in real-time advertising, are a key point in the advertising chain where algorithms are used to maximise value to advertisers. The bidding process is automated therefore algorithms must be preconfigured by humans to bid appropriately. The consensus amongst advertisers on both open and private marketplaces is that they require granular data related to their audience segments to ensure that they are bidding to place their creatives in front of their desired target audience. Consequently, the algorithms programmed in the DSP are configured to bid for impressions depending on user device and location, cookie ID, historical data and overlaid with third-party user information from **data management platforms (DMPs)**³³ to try and optimise the audience targeting capability.

Algorithms in the DSP can also be configured to adjust bidding behaviour and integrate external factors such as the current weather, latest news items or any data point that the advertiser considers to be relevant. Of course, bidding strategies can also be customised depending on the performance goals of the campaign, which may be algorithmically configured depending on whether the campaign is targeting CPM, cost per click (CPC), cost per acquisition (CPA) or cost per download (CPD). Furthermore, it is possible to tune the algorithm to limit the amount of times an impression is seen by a user (frequency cap), or limit bidding for inventory or specific consumer demographics if performance targets are not being met.

Some advertisers/ad agencies apply machine learning to a number of different components of this process:

- **Cross device association** (predicting the probability that two devices belong to the same person based on usage patterns, e.g. IP overlap).
- **Intent prediction** (assessing the probability that a consumer is going to buy a new product in a given time period) on an individual level.
- **Audience insights** (creating a model that is good at predicting intent; for instance, extracting behavioural patterns to inform creative design).
- **Response prediction** on an ad impression level (probability that the user may click or watch a video to completion).
- **Fraud detection** (e.g. determining whether traffic is generated by a bot or a real person, the difference between spoofed URLs and real ones, as well as click fraud and genuine interest).
- **Measurement and attribution of impressions** (e.g. market mix models, causal modelling from observational data, propensity matching).³⁴

In line with the above, respondents to a 2019 survey of executives running companies at the intersection of AI and marketing revealed that "Analytics" and "Targeting and Segmentation" were the

³³ A **data management platform (DMP)** is a unifying platform to collect, integrate, analyse first-, second- and third-party audience data from any source, including online, offline, mobile. The data stored and organised on DMP platforms is used for targeting selected audience groups in online campaigns

³⁴ Quora, "How Machine Learning Is Taking Over Online Advertising," *Huffington Post* (blog), June 7, 2017, https://www.huffingtonpost.com/entry/how-machine-learning-is-taking-over-online-advertising_us_59378051e4b04ff0c46682dc. See also: The Paradox of Big Data and Predictive Modeling: Tales from the Data Trenches of Display Advertising <https://www.ias.edu/ideas/2015/perlich-data-video>

most common service offerings amongst newly formed companies.³⁵ The primary goal of these services are to generate new revenue, retain existing customers or acquire new customers. Respondent expected these machine learning applications to persist over the next 5 years.³⁶

³⁵ Daniel Faggella, "Machine Learning Marketing – Expert Consensus of 51 Executives and Startups," Emerj, accessed June 12, 2019, <https://emerj.com/ai-market-research/machine-learning-marketing/>.

³⁶ Ibid.

2. User data and consumer profiling in the programmatic advertising ecosystem

The programmatic advertising ecosystem is currently predicated on the premise that to reap the apparent advantages of programmatic advertising and real-time bidding, marketers need to understand demographics and behaviours of their potential customers, and then categorise them accordingly to serve them the most appropriate content. For this, advertisers utilise both online and offline data from three main sources:

- **First-party data** is the advertiser’s own data on their customers. It includes data on behaviours, actions or interests collected from across the advertiser’s website(s), app(s), social media and subscriptions.
- **Second-party data** is collected by someone other than the advertiser, an agency for example, who shares that data with the organisation to help develop the advertising strategy. The data is shared to the mutual benefit of the organisations and is not publicly available.
- **Third-party data** is available to anyone at a cost and usually sold by data brokers – who are not the original collectors of the data. The data brokers aggregate the data from other websites and publishers to form large datasets

Advertisers normally **build user profiles by assigning a cookie to users** when their ads are displayed on websites or by **placing tracking pixels** on web pages.³⁷ This enables advertisers to identify and profile users as they browse the internet, across both desktop and mobile devices. Cookie syncing and pixel matching are the processes of: i) sharing information and data about online users across different platforms, advertisers, AdTech vendors, data providers, and publishers; then ii) mapping that data and attributing them to a unique User ID. The process allows advertisers to build profiles of online users with whom they have no direct contact or relationship.³⁸ Furthermore, beacon technology unifies data across agnostic platforms to deliver advertising and messaging that are contextually and geographically relevant to an individual (e.g. an advert is served when a consumer enters a shop based on the signal from a mobile device).³⁹ Other mechanisms of tracking user behaviour includes canvas fingerprinting⁴⁰ and event tracking⁴¹. Critics argue that this tracking of user activity across the internet may represent a breach of user privacy.⁴²

DMPs utilised by advertisers use the personal data from the bid request to contribute to their existing profiles of the user. There are no technical measures that prevent the recipient of a bid request from, for example, combining them with other data to create a profile, or from selling the data on. Indeed,

³⁷ A pixel is a short snippet of javascript (code). In the context of marketing/advertising tags and pixels, they are often collecting some information about the visitor to a website and their behaviour on the site. This is then sent back to the respective marketing/advertising platform to be processed and reported.

³⁸ Lukasz Olejnik, Minh-Dung Tran, and Claude Castelluccia, “Selling off Privacy at Auction” (Internet Society, 2014), <https://doi.org/10.14722/ndss.2014.23270>.

³⁹ “Beacons: Better than Display Advertising?,” Marketing Tech News, accessed February 28, 2019, <https://www.marketingtechnews.net/news/2016/aug/17/beacons-better-display-advertising/>.

⁴⁰ Canvas fingerprinting works by exploiting the HTML5 canvas element: when a user visits a website their browser is instructed to “draw” a hidden line of text or 3D graphic that is then rendered into a single digital token, a potentially unique identifier to track users without any actual identifier persistence on the machine. Cao *et al.* (Cross-)Browser Fingerprinting via OS and Hardware Level Features. NDSS ’17, 26 February – 1 March 2017

⁴¹ Event tracking allows the deployer to record user interactions with various web elements like a menu system driven by Flash. This can be done by attaching a piece of code to an element in the website.

⁴² Mozilla Internet Health Report, “The Good, the Bad and the Ugly Sides of Data Tracking,” January 29, 2018, <https://internethealthreport.org/2018/the-good-the-bad-and-the-ugly-sides-of-data-tracking/>.

there is a commercial incentive to create profiles of users using data from as many sources as possible, including data brokers, to be able to accurately profile individuals or sell this information.⁴³

On the large platforms, Facebook Ads and Google Ads integrate data from multiple sources to enable advertisers to target users more specifically. This includes the user information and activities across services and products of both companies such as Instagram and YouTube, respectively. If a user provides a phone number or email address when interacting with other businesses, for example signing up to a newsletter, that third-party business can add those details to a customer list which can be matched to a Facebook profile to serve ads to that user. Websites and applications can send user data directly to Facebook via Facebook pixels, APIs, SDKs and social plugins. Finally, location data from desktop and mobile devices is also captured and utilised to serve advertisements to users in a specific area⁴⁴.

2.1 Analysis of data use in the programmatic advertising ecosystem

Advertisers utilise first party and third party data from data brokers, who synthesize browsing data, based on cookies and browser behaviour, and then apply proprietary heuristics or machine learning – which are typically a black box – to make inferences about consumers.⁴⁵ Essentially, marketers use algorithms to predict the probability that an individual will be interested in the product/service. The increasing use of data brokers itself suggests that the advertisers are satisfied with their return on investment.

Trusov *et al.* demonstrate that consumer profiling in general can be biased because many ad networks and data brokers only obtain a partial view of consumer behaviour across websites, leading to wrong inferences about user characteristics. The authors emphasize that the quality of the data (rather than simply quantity) is of vital importance.⁴⁶ Lerner *et al.* note that in 2016, about 90 percent of the 500 most popular websites sent information about their visitors to at least one third party.⁴⁷ Indeed the authors conclude that tracking has become more prevalent since 1996, the scope of the top 10 trackers – which cover over 70% of the market - has increased to provide them with a broader view of user browsing behaviours. This may have implications for users who are concerned about privacy when generally browsing the web.

According to the results of the field studies conducted by Neumann *et al.*, the digital ecosystem, spanning technology platforms and data brokers, has only a **small ability to accurately identify age and gender using black-box profiling and inferential algorithms**. The authors demonstrate that, whilst integrating information from data brokers into DSPs improves the likelihood of successfully targeting an individual with a specific gender and in a particular age range, there is an unattractive benefit to cost ratio, even for the best performing advertising platform. Furthermore, the authors demonstrate that the use of third-party audience information alone is on average less efficient at attributing gender than using no third-party audience information at all⁴⁸. The authors estimate that, given the increasing

⁴³ Johnny Ryan, "Report from Dr Johnny Ryan – Behavioural Advertising and Personal Data," accessed October 4, 2018, <https://brave.com/Behavioural-advertising-and-personal-data.pdf>.

⁴⁴ About Facebook Ads: <https://www.facebook.com/about/ads>

⁴⁵ Neumann, N., Tucker, C. and Whitfield, T. (2018). How Effective Is Black-Box Digital Consumer Profiling And Audience Delivery?: Evidence from Field Studies.

⁴⁶ Michael Trusov, Liye Ma, and Zainab Jamal, "Crumbs of the Cookie: User Profiling in Customer-Base Analysis and Behavioral Targeting," *Marketing Science* 35, no. 3 (April 28, 2016): 405–26, <https://doi.org/10.1287/mksc.2015.0956>.

⁴⁷ Adam Lerner et al., "Internet Jones and the Raiders of the Lost Trackers: An Archaeological Study of Web Tracking from 1996 to 2016,".

⁴⁸ Nico Neumann, Catherine E. Tucker, and Timothy Whitfield, "How Effective Is Black-Box Digital Consumer Profiling and Audience Delivery?: Evidence from Field Studies," *SSRN Electronic Journal*, 2018, <https://doi.org/10.2139/ssrn.3203131>.

popularity of running online campaigns based on data broker audience data, the poor accuracy of digital profiles leads to wastage of approximately US\$7 billion globally.

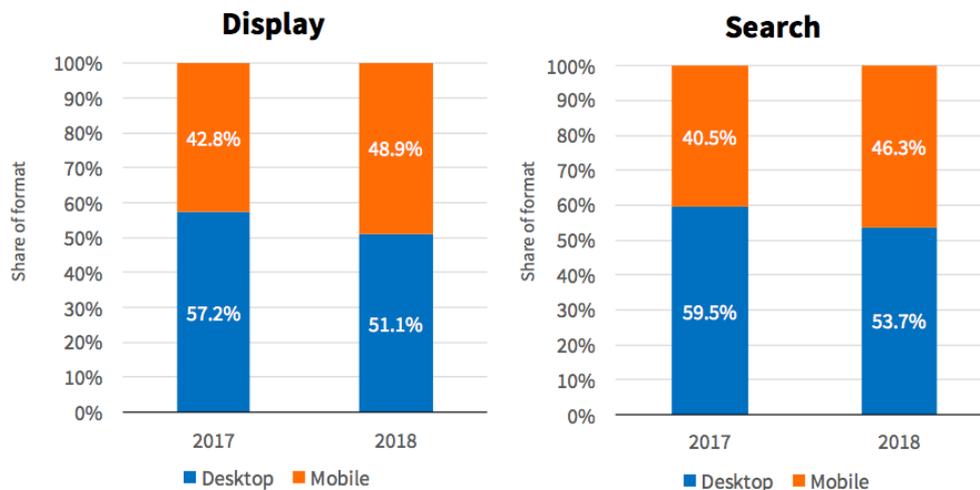
Lambrecht and Tucker assessed the effectiveness of individually customized ads, to show that they were on average less effective than their generic equivalents. The authors demonstrates that behavioural targeting performs well only when consumers narrowly construe their preferences - which illustrates that the performance of behavioural targeting differs depending on the stage the consumer is at along the decision making journey.⁴⁹

Claudia Perlich, Adjunct Professor at Stern, NYU suggests that it is extremely difficult to demonstrate a causal relationship between algorithmic predictive models, that identify ‘consumers of interest’, and post-view conversion (e.g. buying a product); indicating that targeting is confounding, as ads are shown to individuals who are most likely convert (e.g. buy a product after seeing an advertisement).⁵⁰

2.2 Mobile-web advertising vs. application advertising

There is a global trend of increased advertising expenditure on mobile in comparison to desktop. Mobile advertising expenditure in Europe now represents almost 50% of total digital ad expenditure in both display and search formats (Figure 3)⁵¹. In the US, 63% of all digital advertising expenditure in 2018 was for mobile, up from 7% in 2012. This shift of advertising to mobile devices is likely due to increased use of smartphones and tablets amongst the general population. The IAB estimates that around two-thirds of users use desktop and mobile devices, but tablets and smartphones account for 7% of the usage time.⁵²

Figure 3: Mobile vs. Desktop Advertising Expenditure



Source: IAB Europe AdEx Benchmark 2018 Study

⁴⁹ Anja Lambrecht and Catherine Tucker, “When Does Retargeting Work? Information Specificity in Online Advertising,” *SSRN*, October 2013, <https://dspace.mit.edu/handle/1721.1/88160>.

⁵⁰ See Claudia Perlich video on The Paradox of Big Data and Predictive Modeling <https://www.ias.edu/ideas/2015/perlich-data-video> and Ori Stitelman and Brian Dalessandro, “Estimating The Effect Of Online Display Advertising On Browser Conversion,” 2011., 9.

⁵¹ “IAB Europe AdEx Benchmark 2018 Study” (IAB Europe).

⁵² “IAB Internet Advertising Revenue Report” (IAB), <https://www.iab.com/wp-content/uploads/2018/11/IAB-WEBINAR-HY18-Internet-Ad-Revenue-Report1.pdf>.

As of 2015, approximately 60% of ad spending was in-app when compared to mobile web; that figure is expected to be greater now.⁵³ Smaato, a real-time advertising platform for mobile publishers and app developers, noted that through its platform upwards of 95% of mobile advertising in European markets occurred in-app rather than on mobile web.⁵⁴ Whilst up-to-date and accurate figures are hard to come by, there does seem to be a trend of advertisers increasingly targeting their expenditure towards applications rather than mobile web.

The majority of mobile advertising occurs programmatically. It is forecast that mobile programmatic ad spending in general will reach \$32.78 billion in the US in 2018, representing 70.4% of all outlays on programmatic digital display ads. In France it is estimated that 84% of mobile programmatic display ad spending is via programmatic advertising.⁵⁵ In Germany, programmatic ad spending is estimated at 68% of all mobile display ad spending⁵⁶, whilst in the UK programmatic ad spending was thought to represent 83% of mobile spending in 2018.⁵⁷

According to a 2017 IAB study,⁵⁸ the effectiveness of mobile web and in-app advertising appears to be similar with users taking some sort of an action 45% and 47% of the time, respectively.⁵⁹ For mobile web ads, about 11% of users reported that they clicked on the ad whilst 8% said they visited the brand's website after seeing the ad. For in-app ads, the numbers were similar, with 13% saying they clicked and 9% visiting the brand's website after seeing an ad (although other evidence suggests that click-through rates are as low as 0.1%)⁶⁰.

With regard to **buying and selling inventory**, there is no real difference between desktop and mobile web; in both cases advertisers choose their target audiences, who are served impressions that are won by the highest bidder. Inventory purchases are also similar in-app, where advertisers can directly purchase from publishers or participate in RTB auctions. An in-app ad SDK (Software Development Kit) is a set of tools used by app developers to integrate their apps with mobile ad networks and start serving ads on their inventory to earn revenue. Once the SDK is integrated, developers can use the ad networks' dashboard to manage multiple factors, including ad formats, revenue management and analytics. There is a **big difference, however, in how user data is harvested in-app compared to mobile web/desktop**.

Desktop and mobile web user data is collected via cookies. With mobile apps, user data is provided through unique device identifiers, known as a unique device ID, and not through cookies. The Apple IDFA and Google Ad IDs are the unique device ID's for IOS and Android, respectively. A device ID is a string of numbers and letters that identifies every individual smartphone or tablet in the world. The ID number itself is stored on the mobile device and it can be retrieved by any app that is downloaded and installed. Apps typically retrieve the ID to use it for identification when talking to servers. Device ID's

⁵³ "In-App Advertising Spend Outpaces Mobile Web Based Spend 3X," *Solomozone* (blog), March 25, 2015, <https://solomozone.com/2015/03/25/in-app-advertising-spend-outpaces-mobile-web-based-spend/>.

⁵⁴ "Mobile Programmatic Ad Spending Share, In-App vs. Mobile Web, by Country, Europe Performance Metrics, Estimates and Historical Data | EMarketer," *Mobile Programmatic Ad Spending Share, In-App vs. Mobile Web, by Country, Europe Performance Metrics, Estimates and Historical Data | eMarketer*, accessed June 13, 2019, <https://www.emarketer.com/performance/channel/5a05c10af45a9a0d20adaf06/59f71183bfce890eb411fe31>.

⁵⁵ Mobile Programmatic Display Ad Spending in France, 2014-2018: <https://www.emarketer.com/Chart/Mobile-Programmatic-Display-Ad-Spending-France-2014-2018-millions-of-change-of-total-mobile-display-ad-spending/196797>

⁵⁶ "Half of Mobile Display Advertising Now Driven by Programmatic Technologies in Germany," *Business of Apps* (blog), September 29, 2016, <http://www.businessofapps.com/news/half-of-mobile-display-advertising-now-driven-by-programmatic-technologies-in-germany/>.

⁵⁷ "Programmatic Ad Spending in the UK 2019," eMarketer, accessed February 27, 2019, <https://www.emarketer.com/content/programmatic-ad-spending-in-the-uk-2019>.

⁵⁸ IAB On Device Research, "Always On – A Global Perspective of Mobile Consumer Experience" (IAB, June 2017), <https://www.iab.com/wp-content/uploads/2017/06/2017-IAB-Global-Mobile-Experience-Study.pdf>.

⁵⁹ Taking an action: remembering the brand advertised and interacting with the ad are the most mentioned responses

⁶⁰ Gian M. Fulgoni, "In the Digital World, Not Everything That Can Be Measured Matters: How to Distinguish 'Valuable' from 'Nice to Know' Among Measures of Consumer Engagement," *Journal of Advertising Research* 56, no. 1 (March 1, 2016): 9–13, <https://doi.org/10.2501/JAR-2016-008>.

can provide user location, device type, app downloads, if and how a user uses an app, and the number of times an ad has been viewed within an app. Similarly to cookies, these data points allow advertisers to build a profile of the user using real and inferred information. For example, location tracking may allow advertisers to know if an individual is a parent, if they regularly perform school runs, or their religious beliefs, if an individual regularly attends a place of worship – and then target them accordingly.

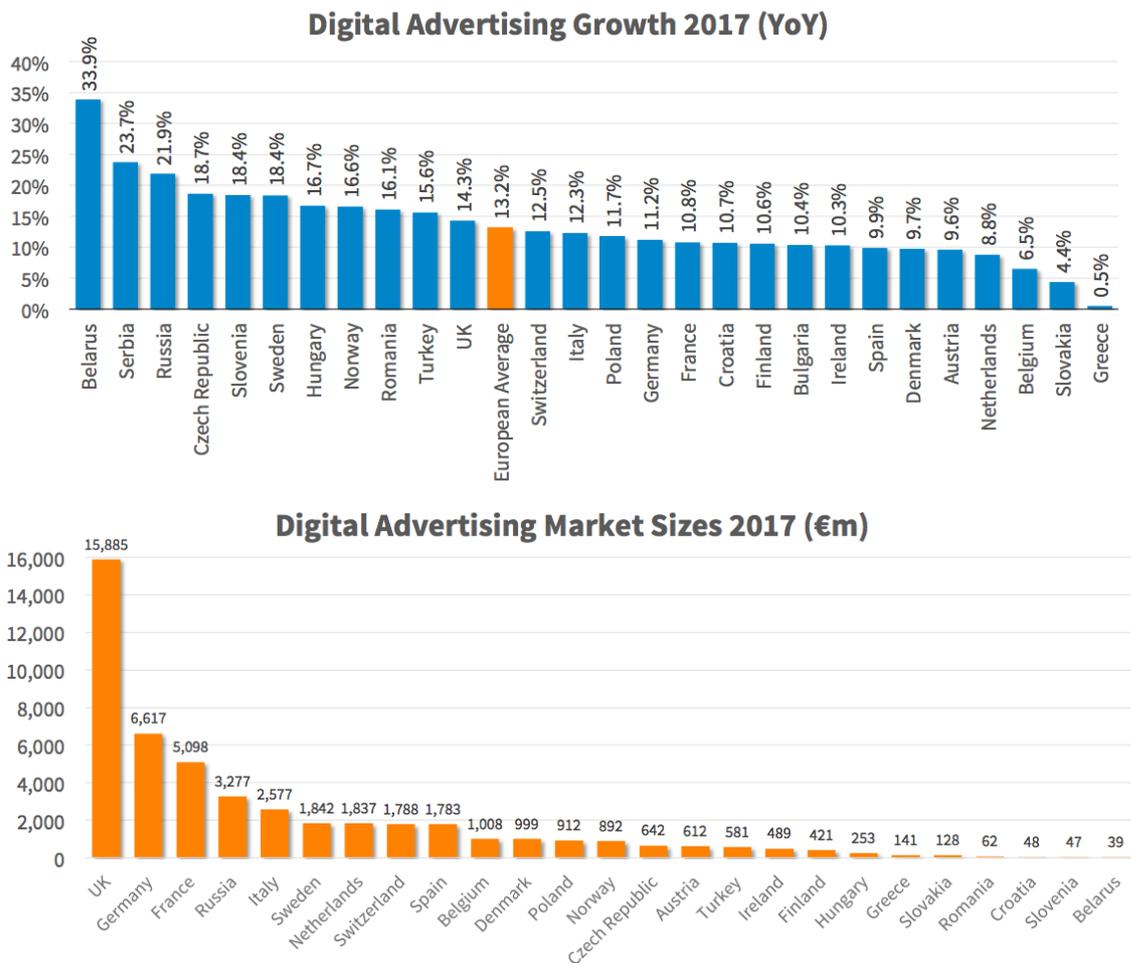
Upon downloading an application, individuals may be automatically opted-in to its policies which may include, for example, permission to track a user's location and mobile usage activity. Unlike cookies which have a limited lifespan, the Device ID lasts for the lifetime of the product unless the user chooses to manually reset it. Both Android- and IOS-enabled devices provide users with the option of opting-out so that information is no longer sent to advertisers. However, researchers recently established that using the resettable advertising ID function on Android phones had little success: of the 3,454 apps that share the resettable ID with advertisers, 66% transmit other, non-resettable, persistent identifiers as well, negating any intended privacy-preserving properties of the advertising ID.⁶¹

⁶¹ Irwin Reyes et al., "'Won't Somebody Think of the Children?' Examining COPPA Compliance at Scale," *Proceedings on Privacy Enhancing Technologies* 2018, no. 3 (June 1, 2018): 63–83, <https://doi.org/10.1515/popets-2018-0021>.

Economic Overview of the Programmatic Advertising Ecosystem

The digital advertising market is proving to be extremely dynamic and growing quickly. Gross digital advertising expenditure in Europe totalled €48.0 billion in 2017 (of which €28 billion was spent in the UK, Germany or France), up 13.2% from €42.5 billion in 2016 and the market has doubled in size over the past 5 years⁶². Czech Republic, Slovenia and Sweden all experienced over 18% of growth in 2017 (Figure 4), exemplifying the high rate of growth in the Central and Eastern Europe and Nordic Markets. In the UK, the spend on digital out-of-home advertising is set to overtake classic billboard advertising⁶³. Furthermore, this growth is driven by the growth of digital mediums; it is projected that the total global investment on digital media is projected to be within a range of \$400 billion to \$500 billion by 2025.⁶⁴ This rapid rate of growth highlights a need to for both industry, policymakers and regulators to be fully informed on the latest developments, thus enabling them to make decisions that are best for industry whilst also benefiting citizens.

Figure 4: Digital Advertising Trends in Europe (% growth and Market Size)



⁶² IAB Europe and IHS Markit Report – AdEx Benchmark 2017

⁶³ “Google’s Targeted Ads Are Coming to a Billboard Near You - Bloomberg.”

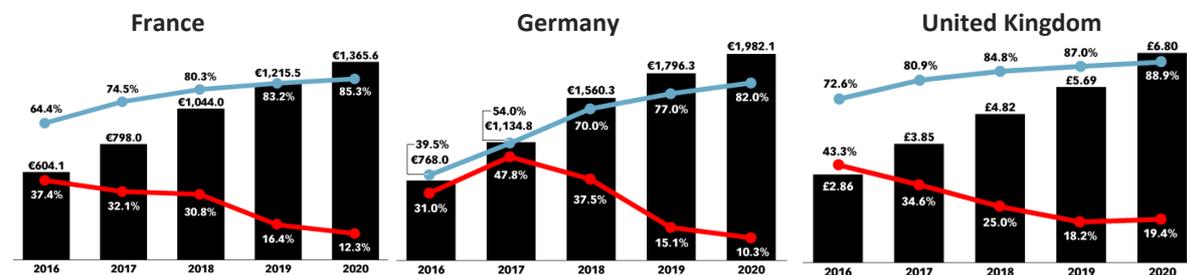
⁶⁴ Based on historical trends from GroupM and ZenithOptimedia, plus WFA projections based on future market forces

Source: IAB Adex Benchmark Study 2018

2.3 Programmatic advertising

The European Programmatic Market Sizing Report joint-produced by IAB Europe and IHS Markit reveals that the total programmatic display advertising market in Europe experienced a year of double-digit growth jumping 27.1% to €12bn in 2017.⁶⁵ Programmatic revenues were €10.8bn Western Europe and €1.2 in Central and Eastern Europe.⁶⁶ Programmatic advertising represented over 70% of the total digital advertising spend in Germany in 2018, with the figure being as high as 80% and 84% in France and the UK. The proportion spent on programmatic advertising is expected to rise in the next 2 years (Figure 5).

Figure 5: Programmatic Digital Display Ad Spending in France, Germany and the United Kingdom



Programmatic digital display ad spending
 % of total digital display ad spending
 % change

Source: eMarketer, Dec 2018

In the US, eMarketer estimates that nearly \$46bn will be spent on programmatic advertising by the end of 2018, which would mean that 82.5% of all US digital ad spend will be bought automatically. Figure 6 demonstrates that 58% of this is expected to be orchestrated through Programmatic Direct advertising and 38% will be displayed via RTB.⁶⁷ This is in stark contrast to 2013, where 98% of total programmatic digital display was transacted via RTB.⁶⁸ In the UK, the rate of **Programmatic Direct ad spend growth is now similar to the rate of RTB ad spend growth.**⁶⁹

⁶⁵ IAB Europe Report: European Programmatic Market Sizing 2017

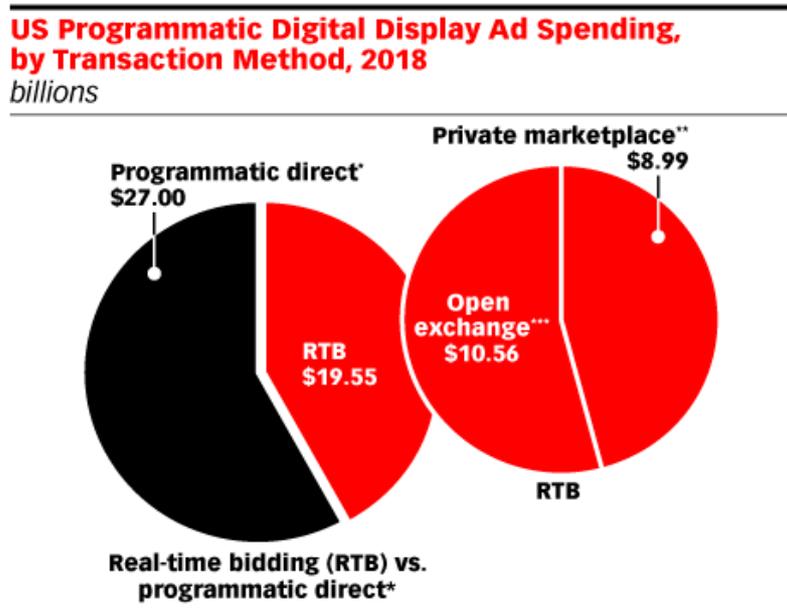
⁶⁶ Ibid.

⁶⁷ "More than 80% of Digital Display Ads Will Be Bought Programmatically in 2018," eMarketer, accessed February 27, 2019, <https://www.emarketer.com/content/more-than-80-of-digital-display-ads-will-be-bought-programmatically-in-2018>.

⁶⁸ "Why AppNexus Is Betting on the Power of Programmatic Direct | ExchangeWire.Com," accessed February 27, 2019, <https://www.exchangewire.com/blog/2015/03/18/why-appnexus-is-betting-on-the-power-of-programmatic-direct/>.

⁶⁹ "UK Real Time Bidding (RTB)* vs. Programmatic Direct** Ad Spending Growth, 2014-2018 (% Change) - EMarketer," accessed February 27, 2019, <https://www.emarketer.com/Chart/UK-Real-Time-Bidding-RTB-vs-Programmatic-Direct-Ad-Spending-Growth-2014-2018-change/197229>.

Figure 6: US Programmatic Digital Display Ad Spending by transaction method, 2018.

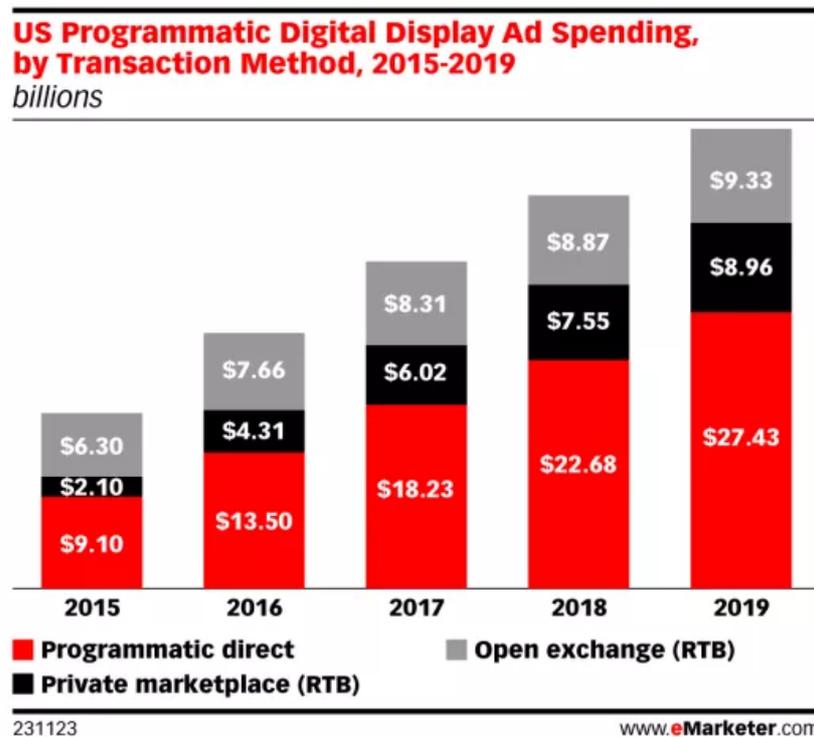


In the US, in 2018, 54% of RTB is expected to occur on the open exchange, whilst private marketplaces – including ads transacted through an invitation-only RTB auction where one publisher or a select group of publishers invite a select number of buyers to bid on its inventory – will account for the remaining 46%. Figure 7 demonstrates that RTB advertising spend transacted on private marketplaces is expected to surpass the advertising spend on the open exchange in 2019. This **shift to private marketplaces** is primarily being driven by shifting attitudes and behaviours in advertisers who are: seeking to increase spend on verifiably brand safe channels⁷⁰; demanding transparency from agencies and suppliers;; increasing spend with premium content publishers.⁷¹

⁷⁰ “Avoiding the Unsavory & Measuring Safety - AdColony,” accessed February 27, 2019, <https://www.adcolony.com/blog/2018/02/13/avoiding-unsavory-measuring-safety/>.

⁷¹ “The Brand Safety Dilemma: Looking Beyond Scale and Efficiency to Quality, Context and Common Sense - EMarketer,” accessed February 27, 2019, <https://www.emarketer.com/Report/Brand-Safety-Dilemma-Looking-Beyond-Scale-Efficiency-Quality-Context-Common-Sense/2002206>.

Figure 7: US Programmatic Digital Display Ad Spending by transaction method, 2015-2019.



As illustrated above, the current programmatic advertising ecosystem contains **intermediaries** that link the advertiser and the publisher. The World Federation of Advertisers estimates that only 40% of programmatic advertising spend is received by the publisher, whilst the IAB estimates this at 55%.⁷² The IAB highlights that advertisers are often paying significantly higher CPMs for programmatic non-guaranteed buys than a publisher receives net of fees due to programmatic media’s focus on efficiency.⁷³ The IAB cite a lack of transparency across the value chain, where, for example, technology fees are disaggregated from CPMs, resulting in buyers and sellers evaluating inventory value and ROI based on limited information. The IAB has called for a more transparent bidding process whereby the ultimate value of an auction is to expose buyers’ true valuations of seller assets while enabling equitable transactions based on that valuation. To this point, it has been estimated that a significant portion of advertiser spend in the programmatic advertising ecosystem (up to 42%) is ‘non-working’ and is, in fact, consumed by transaction and data fees.⁷⁴

Figure 8 demonstrates the flow on money through the programmatic advertising ecosystem. It is estimated that 10-50% of advertiser investment is lost to advertiser fraud (discussed in greater depth below).⁷⁵ The nature of the advertising ecosystem is important to highlight here because much of the ‘formal’ industry has already been involved and paid for their part in the process before the perpetrator enters the chain. In other words, the intermediaries of the advertising chain are inadvertent

⁷² IAB Programmatic Fee Transparency Working Group, “The Programmatic Supply Chain: Deconstructing the Anatomy of a Programmatic CPM” (IAB, March 2016), <https://www.iab.com/wp-content/uploads/2016/03/Programmatic-Value-Layers-March-2016-FINALv2.pdf>.

⁷³ IAB Digital Simplified, “Transparency Is The Key To Programmatic Success” (IAB, 2015), <https://www.iab.com/wp-content/uploads/2015/06/IABDigitalSimplifiedProgrammaticAdvertisingTransparency.pdf>.

⁷⁴ Ibid.

⁷⁵ Mikko Kotila, Ruben Cuevas Rumin, and Shailin Dhar, “Compendium of Ad Fraud Knowledge for Media Investors” (WFA and THE ADVERTISING FRAUD COUNCIL, 2016).

benefactors of ad fraud, which may distort the incentives and/or urgency to create a more transparent ecosystem.⁷⁶

Figure 8: Overview of money flow through the programmatic advertising value chain. Adapted from WARC Global Ad Trends 2018



2.4 Key players in the programmatic advertising ecosystem

In 2017, Google and Facebook maintained their dominance of worldwide digital ad revenue share with 33.0% and 16.2%, respectively⁷⁷. Given that together they account for such a high proportion of online advertising revenue, it is reasonable to further examine how Google and Facebook operate in relation to the rest of the online advertising ecosystem.

In the online advertising market, publishers and social media platforms compete for share of audience and advertising expenditure. Google and Facebook - account for the majority of expenditure in search and display advertising, respectively. Broadcasters, news brands and a long tail of small publishing sites compete for audiences and display advertising revenue with these big players of display and social inventory.

⁷⁶ Mikko Kotila, Ruben Cuevas Rumin, and Shailin Dhar, "Compendium of Ad Fraud Knowledge for Media Investors" (WFA and THE ADVERTISING FRAUD COUNCIL, 2016).

⁷⁷ "Net Digital Ad Revenue Share Worldwide, by Company, 2016-2019 (% of Total and Billions) - EMarketer."

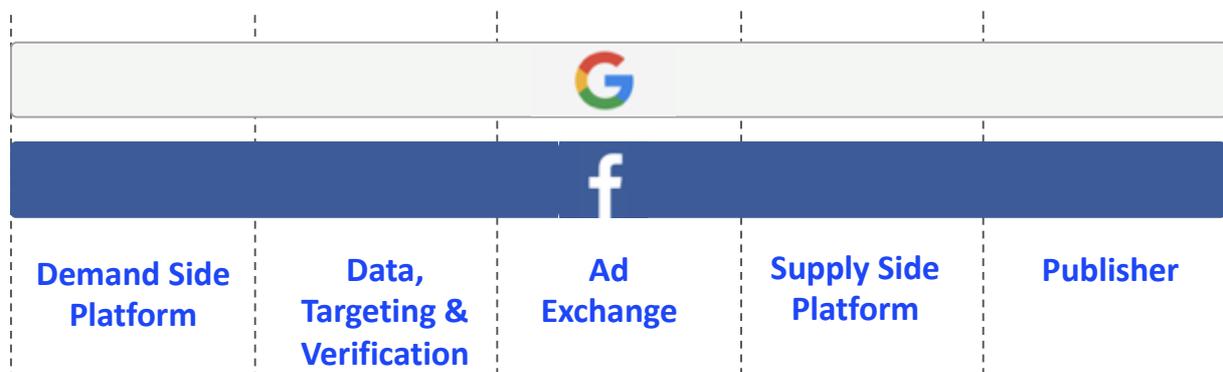
The advertising technology vendors in the ecosystem compete for intermediary services revenue; Google is leader in the DSP and SSP/ad exchange markets and the rest of the market is fragmented as companies compete for advertiser, agency and publisher integrations and share of spend.⁷⁸

Major internet companies, such as Google, Facebook, Microsoft and Amazon, have developed automated online sales interfaces that enable them to sell ad impressions on their sites as publishers, to media agency and advertiser customers, including a long tail of small businesses. These interfaces allow customers to set campaign objectives and budgets, select target audiences and placements, and upload ad creative. There is a long tail of operators who aggregate smaller-scale publishers and resell inventory on exchanges/SSPs.

One of the reasons for the large market share of Google and Facebook companies is that they **occupy several positions across the digital advertising value chain** (Figure 9). They provide popular online services from which they can **perform analytics and capture user data**. This data can be combined with data from additional sources to profile users, thereby allowing advertisers to target a specific audience, for which advertisers are willing to pay a premium. They also both **operate ad exchanges** to connect advertiser’s content with publisher inventory, as well as supply and demand side platforms. Finally, they have **ad space/inventory on their own platforms** where they are able to serve impressions to users.

Google are able to display advertising content on Google Search, YouTube and Gmail. Furthermore, websites and app developers partner with Google to display adverts based on the user information that Google has collected from online activities on these third party sites and applications (See section 2.2). Facebook displays advertisements across their services such as on its News Feed and Instagram. Similarly to Google, the Facebook Audience Network enables advertisers to serve their content to users across third party apps and websites.

Figure 9: Google and Facebook occupy several roles on the value chain



The effect of occupying several positions on the programmatic advertising value chain is multi-faceted. In the context of competition, the economies of scale and scope, network effects in display intermediation and digital user services markets, vertical integration and access to data to enhance the targeting and measurement of advertising campaigns may present barriers to market entry and expansion to competitors. This may be further exacerbated by Google and Facebook collecting multiple first-party datasets from large numbers of logged-in users, but sharing only aggregated data

⁷⁸ Stephen Adshead et al., “Online Advertising in the UK,” 2019, 110.

with partners.⁷⁹ The is a high degree of opacity in the market makes it difficult to assess the extent which such practices are occurring and represent a competitive advantage.

In summary:

- Both Google and Facebook have extensive proprietary data. Google have user data gathered at scale from a portfolios of services. Search data provides insight into user intent, whilst behavioural data can be inferred from services such as Gmail and Google Maps. Facebook has access to highly granular data about user social networks, interests and behaviours.
- Both organisations have well-developed advertising technology platforms. Google and Facebook intermediate in the purchase of advertising on third-party services by leveraging their technology and data.
- Both organisations have a large scale of owned advertising inventory. Google and Facebook have access to large quantities of advertising inventory generated by their own services (YouTube video ads, Google paid search ads; Facebook and Instagram ads).
- Google have also developed technologies in adjacent markets such as web browsers (Google Chrome), operating systems (Google Android), cloud (Google Cloud) that confers a competitive advantage in the digital advertising ecosystem.

2.5 Publisher effectiveness in the ecosystem

For publishers and SSPs, **revenue maximisation** is a key issue for which algorithmic systems are developed and deployed. Revenue maximisation models are being developed for publishers to optimise the amount of future impressions they sell in advance via programmatic direct, and which to sell via RTB on the open market. For a specific ad slot (which targets specific types of users), the estimated total impressions in a future period could be evaluated and allocated algorithmically between the guaranteed market and the RTB auction.⁸⁰

However, some critics argue that programmatic advertising is used to the overall detriment of publishers. They claim behavioural advertising facilitated by RTB has arguably led publishers to produce more content for the attention of the audience rather than focusing on high quality journalism. Furthermore, it has arguably led to the increased use of ad-blockers which has an impact on publisher revenue.⁸¹

Furthermore, advertisers no longer need publishers to directly reach highly targeted audiences. This is because platforms have disintermediated the traditional relationship between publishers and advertisers.⁸² This disintermediation coupled with the small concentration of market power in the online advertising ecosystem, has arguably created a monopsony situation, where publishers – the

⁷⁹ Stephen Adshead et al., “Online Advertising in the UK,” 2019, 110.

⁸⁰ Bowei Chen, Shuai Yuan, and Jun Wang, “A Dynamic Pricing Model for Unifying Programmatic Guarantee and Real-Time Bidding in Display Advertising,” in *Proceedings of 20th ACM SIGKDD Conference on Knowledge Discovery and Data Mining - ADKDD’14* (20th ACM SIGKDD Conference, New York, NY, USA: ACM Press, 2014), 1–9, <https://doi.org/10.1145/2648584.2648585>.

⁸¹ Doc Searls (2017). How True Advertising Can Save Journalism From Drowning in a Sea of Content. <http://blogs.harvard.edu/doc/2017/01/26/how-true-advertising-can-save-journalism-from-drowning-in-a-sea-of-content/>

⁸² Sara M. Watson et al., “The Future of Advertising and Publishing,” 2018, <https://doi.org/10.7916/D8KP9DPJ>.

suppliers of advertising views to the marketplace - are compelled to do business on terms which have been dictated to them.⁸³

RTB allows advertisers to display content beyond the well-known publishers of the online world and reach the available inventory space of niche websites. The perceived benefit of this is the ability to serve millions of impressions at very low bids in order to drive brand awareness for example. RTB also allows flexibility for advertisers during periods where demand for display advertising space exceeds the supply of quality inventory. Advertisers can then buy inventory from the 'long tail' of smaller publishers and exchanges but where verification checks are likely to be less rigorous.

However, a recent study⁸⁴ suggests 'premium publishers' delivered significantly better branding effectiveness results across a number of measures.⁸⁵ **The primary driver of this increased effectiveness was the 'halo effect' that comes from the value of the contextual environment in which these ads are seen.**⁸⁶ Furthermore, the 'cheap reach' facilitated by RTB has been said to contribute to the proliferation of 'low quality' sites that sell advertising space, which is in turn associated with brand safety issues and the decreased sustainability of 'premium' sites due to re-direction of advertising spend.

2.6 Ad Fraud in the programmatic ecosystem

Ad fraud can be defined as "association with an activity where impressions, clicks, actions or data events are falsely reported to criminally earn revenue, or for other purposes of deception or malice".⁸⁷ In 2017, The World Federation of Advertisers and the Advertising Fraud Council produced a "Compendium of ad fraud knowledge for media investors" in which they state that, at the present time, virtually any programmatic buy can be exposed to ad fraud.⁸⁸ **The endemic nature of viral spam sites and low quality publisher sourced traffic, which is common place among publishers reduces advertising effectiveness.** This is illustrated by an experiment conducted by the Guardian US who observed saw that 72% of their video advertising spend on the open exchange went to counterfeit sources.⁸⁹

There are **four primary types of advertising fraud** where it is fraudulently validated that the visitor is authentic, and can be committed by software, a human or a combination of both:

- impression fraud
- click fraud
- conversion fraud

⁸³ Johnny Ryan, "Brave Requests European Commission Antitrust Examination of Online Ad Market," Brave Browser, December 4, 2018, <https://www.brave.com/blog/european-commission-sector-inquiry/>.

⁸⁴ "The Halo Effect: How Advertising on Premium Publishers Drives Higher Ad Effectiveness" (ComScore, 2016), https://www.pdrf.net/wp-content/uploads/2014/09/US_The_Halo_Effect_Premium_Publisher_Study_JUL2016.pdf.

⁸⁵ Favourability, consideration and intent to recommend

⁸⁶ "The Halo Effect: How Advertising on Premium Publishers Drives Higher Ad Effectiveness" (ComScore, 2016), https://www.pdrf.net/wp-content/uploads/2014/09/US_The_Halo_Effect_Premium_Publisher_Study_JUL2016.pdf.

⁸⁷ Kotila, Rumin, and Dhar, "Compendium of Ad Fraud Knowledge for Media Investors."

⁸⁸ Botlab.io, a research foundation focused on researching ad fraud, user rights violations and other malicious practices in the online advertising supply-chain supported in the creation, data and research of the document.

⁸⁹ "Guardian US Teams up with Google and MightyHive to Uncover Programmatic Ad Fraud on the Open Exchange and Test Ads.Txt," *The Guardian*, July 23, 2018, sec. Guardian US press office, <https://www.theguardian.com/guardian-us-press-office/2018/jul/23/guardian-us-teams-up-with-google-and-mightyhive-to-uncover-programmatic-ad-on-the-open-exchange-and-test-adtstxt>.

- data fraud

It is estimated that a significant majority of the top 5,000 sites (by inventory) available in ad exchanges are some form of viral-news site.⁹⁰ This has the effect of taking a substantial share of overall advertising investment and consequently pressures premium publishers to buy sourced traffic (this is a practice used to deliver campaign targets to advertisers)⁹¹.

Furthermore, the **scale of non-human traffic is large**. Adobe inspected traffic across thousands of its client's sites and found that 28% of the traffic showed "non-human signals" indicating that it was fraudulent.⁹² The WFA report states:

"Traffic can be acquired specifically to meet the requirements of leading verification vendors, at well below \$0.01 per click, including audience measurement companies and counter ad fraud companies. It may also be manipulated to have the appearance of higher viewability rates than legitimate traffic. Whereas legitimate publishers can only offer what they actually have, perpetrators of ad fraud can adjust their inventory to appear more desirable to buying algorithms, establishing an advantage over legitimate sellers in winning buyer bids for inventory."

As a consequence, algorithms may be configured to prioritise some viral spam sites because of the perception that they contain more desirable inventory. The WFA considers that the pressure trading desks are under to meet budget goals, often set by clients, over any other demand criteria means platform algorithms can be influenced towards buying from poor quality sites.

The impact of ad fraud does not just disrupt the marketing effectiveness and thus constitute a real business cost, but also represents a cost to the national economies. A recent report from Hewlett Packard classifies ad fraud as having a higher 'potential payout' than any other form of digital crime because, at the present time, there is a low risk of prosecution and conviction.⁹³ Transactions by fraudulent actors take place through the formal banking system. In this way, the publisher, who may in fact be a large-scale cybercriminal, can operate as a part of the formal economy.

The WFA assessment states that the unintended main benefactor of ad fraud is the marketing industry, whilst the advertisers are the biggest losers. One of the primary conclusions of the report is that "it is incumbent upon the ecosystem, including publishers and others on the sell-side, plus programmatic companies, agencies and others on the demand-side, to prove that the capability to effectively deal with ad fraud is in place".⁹⁴

⁹⁰ Kotila, Rumin, and Dhar, "Compendium of Ad Fraud Knowledge for Media Investors."

⁹¹ With sourced traffic, a publisher pays a third-party vendor to send users to its site by advertising on other publishers' sites. Sourced traffic may occur when a seller needs to meet the audience delivery requirements of a campaign and has to increase visitors to its site

⁹² Alexandra Bruell, "Fraudulent Web Traffic Continues to Plague Advertisers, Other Businesses," *Wall Street Journal*, March 28, 2018, sec. Business, <https://www.wsj.com/articles/fraudulent-web-traffic-continues-to-plague-advertisers-other-businesses-1522234801>.

⁹³ Hewlett Packard Enterprise, "The Business of Hacking: Business Innovation Meets the Business of Hacking," May 2016, <http://static.politico.com/b9/55/4e3ce4cc41d88401e264dcacc35c/hpe-security-research-business-of-hacking-may-2016.pdf>.

⁹⁴ Kotila, Rumin, and Dhar, "Compendium of Ad Fraud Knowledge for Media Investors."

2.7 Verification and measurement guidelines and standards

The IAB issues measurement guidelines for digital advertising across all platforms and ad formats and recommended practices in ad verification and these are listed below:

- Ad Campaign Measurement Process Guidelines
- Ad Impression Measurement Guidelines, U.S. & Global
- Guidelines for the Conduct of Ad Verification
- Audience Reach Measurement Guidelines
- Click Measurement Guidelines
- Desktop Display impression Measurement Guidelines
- Digital Video Ad Measurement Guidelines
- In-Game Advertising Measurement Guidelines
- Mobile Application (In-App) Measurement Guidelines
- Mobile Web Advertising Measurement Guidelines
- MRC Viewable Impression Guidelines
- Rich Internet Application Guidelines
- Rich Media Measurement Guidelines

However, the advertising industry has yet to fully embrace these guidelines which, for example, means that marketers and media providers use different definitions of what it means for an ad to be visible. The effect of this is that marketers conclude inaccurately about the effectiveness of their ads, which could lead to misguided buying decisions and suboptimal results. If advertisers include *conversions*⁹⁵ from advertisements that, for example, never had a chance to be seen⁹⁶, they could be overvaluing view-through conversions from unseen impressions, incorrectly calculating cost per acquisition (CPA) of different media sources, and making ill-informed spending decisions.

The Media Rating Council (MRC) is funded by media companies, marketers and agencies to set standards for the measurement of audiences in advertising. It considers a digital ad "viewable" if at least half of it appears on-screen for 1 second, or for 2 seconds in the case of video. The MRC is considering toughening that standard to require a whole ad to appear on-screen. In the UK, the Joint Industry Committee for Web Standards (JICWEBS) is an independent organisation that oversees the development of Good Practice and Standards for digital ad trading with the aim of increasing transparency and trust in how digital advertising is bought and sold.⁹⁷ JICWEBS certification is intended to provide proof that a JICWEBS signatory has been independently verified to a set of JICWEBS Standards, and has received certification which demonstrates how a company applies these standards to their business practices.⁹⁸ For example, JICWEBS recommends the use of third-party verification organisations to enhance trust in the market. JICWEBS operates several certification initiatives, each related to a distinct objective area:

- Digital Trading Standards Group (DTSG) Brand Safety group specifically looks at Good Practice and Standards around **Brand Safety**;⁹⁹

⁹⁵ Ad viewers or site visitors who are *converted* to paying customers

⁹⁶ For example, the Interactive Advertising Bureau (IAB) and Media Rating Council (MRC) created a standard definition of ad viewability: At least 50% of an ad must be in view for a minimum of one second for display ads or two seconds for video ads

⁹⁷ JICWEBS is a joint industry currency, made up of the four trade bodies, the AOP, IAB, IPA and ISBA. The Joint Industry Currencies (JICs) are owned by the industry – advertisers, agencies and media owners – to provide transparent and objective audience data.

⁹⁸ JICWEBS signatories can be found here: <https://jicwebs.org/certification-process/signatories/>

⁹⁹ 1. The Buyers and Sellers of digital display advertising shall ensure that the transaction follows a Primary Agreement or Contract; 2. this should include where the advertising should (or shouldn't) appear, using independently-certified Content Verification (CV) tools or schedules; 3. Sellers should confirm how they minimise the risk of ad misplacement, whether inventory is sourced directly or indirectly; 6.

- The Anti-Fraud Commercial Group specifically issues guidelines related to **Ad Fraud Processes and Ad Fraud Tools**;
- **Viewability Product Principles** are issued with regard to products reporting the opportunity to see banner and video content in both desktop and mobile environments, focusing on the capability of the product to measure variables of area and time;¹⁰⁰
- **Content Verification (CV) Product Principles** are designed to test the ability of CV products to block and/or report, in real time, the serving of an online ad onto destinations that have been defined in advance as inappropriate by the advertiser. Content Verification technology is designed to crawl through hundreds of web pages, classifying the content and making decisions on whether the content is appropriate for the advertising campaign.

In January 2018, JICWEBS and its US counterpart, the cross-industry standards body Trustworthy Accountability Group (TAG), began aligning initiatives around brand safety, fraud, malware and piracy in an attempt to create a consistent approach to addressing the problems facing digital advertising and to increase industry adoption across both jurisdictions.

Other industry initiatives include:

- **Coalition for Better Ads**¹⁰¹: A global group whose board includes the Association of National Advertisers, the Interactive Advertising Bureau, Unilever, Facebook, Google. Products include a built in Google Chrome auto-blocker for ad formats that obstruct access to content, in a bid to prevent poor user experiences that may result in them downloading and installing other ad-blocking software.
- **Ads.txt**: Industry standard created by IAB Tech Lab to increase transparency in the programmatic advertising ecosystem. Publishers and distributors can use Ads.txt to publicly declare the companies they authorize to sell their digital inventory.
- **The Advertising ID Consortium**¹⁰²: An independent group composed of supply-side and demand-side technology platforms, as well as marketers and publishers. Their aim is to enable buyers and sellers of programmatic advertising to leverage a two-part identity framework of unified cookies and people-based identifiers to create more relevant campaigns and improve user experiences.
- **Data transparency label**¹⁰³: Proposal by the Advertising Research Foundation and the Coalition for Innovative Media Measurement that aims to introduce a label system that would include basic information on when the data was collected, the data source, the collection method and whether any modelling has been conducted on the dataset. This is in response to a lack of trust that advertisers have with the data used for targeting audiences.

The above clearly indicates trends in the market towards trading in a more trustworthy, transparent and verifiable manner. Furthermore, the establishment of cross-industry standards, although there has not been universal uptake, demonstrates that there is some movement within the ecosystem to solve the pressing issues related to viewability, ad fraud and brand safety. However, Mike Zaneis, CEO of TAG, noted on a panel during Advertising Week that “there may be too many badges and seals out

Sellers should be able to explain the process(es) that do this; 5. They should understand any contractual consequences if they fail to monitor and respond appropriately to ad misplacement via take down; 6. Each Signatory will have their ad misplacement minimisation policies independently verified by a JICWEBS-approved provider.

¹⁰⁰ JICWEBS publish and keep under review industry-wide good practice to deliver transparency of viewable impression measurement, including compliance

¹⁰¹ Coalition for better ads: <https://www.betterads.org/>

¹⁰² <https://www.adidentity.org/>

¹⁰³ <https://adexchanger.com/data-exchanges/advertisers-distrust-data-will-labeling-solve-problem/>

there"¹⁰⁴, highlighting the current fragmented, piece-meal approach to tackling the issues affecting the industry.

Third party verification providers have emerged as potential solution to the lack of transparency in the programmatic advertising ecosystem. They offer independent analytics services that validate whether ad impressions have been served in a brand safe environment; were viewable by the consumer (e.g. did the user scroll down and see the advertisement) and; whether the impression was served to genuine people as opposed to bots. Verification providers place tags on ads which collect data and report this back to their servers. Generally, this process is conducted after ad impressions have been served and is paid for by the advertiser. In some cases, programmatic advertising intermediaries use more than one verification service due to differing requirements across their trading partners. Verification is generally charged on a CPM basis, with buy-side fees equivalent to 1% to 2% of advertiser investment.¹⁰⁵

Questions have been raised whether these third-party measurement providers are indeed fully independent and transparent, given that they are run for profit and rely on data provided by Google and Facebook.¹⁰⁶ The Australian Competition & Consumer Commission (ACCC) found that:

*'...it is not yet clear the extent to which third party measurement overcomes these issues. In particular, it is not clear whether the current terms on which third party verification providers have access to the Facebook and Google platforms enable them to carry out a reliable and fulsome audit of relevant ad metrics and measurements.'*¹⁰⁷

¹⁰⁴ Allison Schiff // Thursday, October 4th, and 2018-12:43 Pm, "The Ad Industry Is Still Figuring Out How To Devise Standards Without Driving Everyone Insane," AdExchanger, October 4, 2018, <https://adexchanger.com/online-advertising/the-ad-industry-is-still-figuring-out-how-to-devise-standards-without-driving-everyone-insane/>.

¹⁰⁵ Stephen Adshead et al., "Online Advertising in the UK," 2019, 110.

¹⁰⁶ Stephen Adshead et al., "Online Advertising in the UK," 2019, 110.

¹⁰⁷ Stephen Adshead et al., "Online Advertising in the UK," 2019, 110.

3. Impact of GDPR on Programmatic Advertising

The introduction of the GDPR has reportedly begun to impact the online advertising industry. This has largely been due to the fact that companies now also *de facto* require user consent to utilise personal data and build individual consumer profiles for targeting.

IAB Europe has developed a Transparency and Consent Framework to provide guidance on these measures.¹⁰⁸ Using the Framework, first-parties (such as publishers) can enable third parties (such as SSPs) to process user data on one of the legal bases of the Regulation. The Framework includes standardised approaches to obtain informed consent to process user data, and pass information relating to these consents to the supply chain.

WhoTracks.Me, an organisation with the aim of increasing transparency to online tracking technologies, has conducted extensive research to monitor the online tracking landscape.¹⁰⁹ The organisation has documented evidence that suggests the GDPR has led to changes in the number of third-party trackers in Europe and the US. The average number of trackers per page for each category of site being visited reveals a general downward trend in Europe of approximately 4%. It was found that trackers on news websites, which traditionally have a larger number of cookies, have been reduced by 22%¹¹⁰. The opposite is true in the US which has seen an increase in the mean number of trackers per page by approximately 8%.¹¹¹ Some websites, for example The Los Angeles Times, interrupted their operations in Europe, while others, such as npr.org, decided to offer text only versions of their websites if the user does not consent to sharing data with third parties. In fact, there have been some changes to the business models of publishers in an effort to comply with GDPR, with some major international publishers withholding content unless users comply with privacy and cookie policies.

In the context of the online advertising ecosystem itself, it has been highlighted by Johnny Ryan, Chief Policy Officer at Brave, that there is **a data protection free zone** in the current infrastructure of the OpenRTB¹¹². Publishers may be compliant with GDPR but this **data protection free zone** occurs when personal data is broadcast between SSPs, Ad Exchanges, DSPs and DMPs after a bid request. This has also been demonstrated by privacy researchers at INRIA who were able to expose a design characteristic of RTB systems to observe the prices which advertisers pay for serving ads to Web users. INRIA confirmed that users with a known history are evaluated higher than newcomers; that some user profiles are more valuable than others; and that users' intents, such as looking for a commercial product, are sold at higher prices than users' browsing histories.¹¹³ Indeed, Johnny Ryan's report argues that:

¹⁰⁸ "The IAB Europe Transparency & Consent Framework: Publishers Factsheet | IAB Europe," accessed June 14, 2019, <https://www.iabeurope.eu/research-thought-leadership/resources/transparency-consent-framework-publishers-factsheet/>.

¹⁰⁹ Arjaldo Karaj et al., "WhoTracks.Me: Monitoring the Online Tracking Landscape at Scale," *ArXiv:1804.08959 [Cs]*, April 24, 2018, <http://arxiv.org/abs/1804.08959>.

¹¹⁰ Reuters Institute for the Study of Journalism (2018) Changes in Third-Party Content on European News Websites after GDPR

¹¹¹ "GDPR - What Happened?," accessed February 28, 2019, <https://whotracks.me/blog/gdpr-what-happened.html>.

¹¹² "Mozilla Co-Founder's Brave Files Adtech Complaint against Google," *Reuters*, September 12, 2018, <https://www.reuters.com/article/us-europe-privacy-complaint/mozilla-co-founders-brave-files-adtech-complaint-against-google-idUSKCN1LS2JL>.

¹¹³ Olejnik, Tran, and Castelluccia, "Selling off Privacy at Auction."

“RTB bid requests do not necessarily need to contain personal data. If all industry actors agreed, and amended the standard under the stewardship of the IAB, then bid requests that contain no personal data could be passed between ad tech companies to target relevant advertising by general context. This, however, would prevent these companies and their business partners from building profiles of people, which would have a revenue implication.”¹¹⁴

The introduction of the GDPR has also meant that several companies that provide services to advertisers as part of the supply chain, such as cross-device user recognition or user location analysis, have ceased operating in Europe because of uncertainties of how the GDPR will be applied and inability to guarantee compliance.¹¹⁵ As a related concept, the WhoTracks.Me report also asked the question: **Has GDPR, designed to enhance user privacy in the web, had any adverse effects on competition?**¹¹⁶ WhoTracks.Me has profiles for more than 1000 trackers of which they have classified 200 as advertising services. For each tracker the authors have data on the percentage of the measured web traffic that they observed the tracker to be loaded (the reach¹¹⁷) as well as the percentage of websites on which the tracker is present (site_reach¹¹⁸). Monitoring these metrics gave them insights into the structure of the market in which these trackers operate, as well as their relative market share. They found that Google had managed to maintain reach and site_reach whilst other advertisers have lost reach and site_reach post-GDPR (i.e. Google had managed to maintain market share whilst others lost market share). WhoTracks.Me concluded – using a tracker's reach as a proxy for market share – that GDPR may have had regressive effects on competition in the online advertising space in Europe. They suggest the reasons are three-fold:

- Google and other big companies have had significant resources dedicated to compliance compared to smaller companies.
- Google acts in the capacity of a gatekeeper, hence it is conceivable to assume it may have used that position in punitive ways. Reports indicate that Google could have encouraged publishers to reduce the number of AdTech vendors.¹¹⁹
- Website owners trying to minimize their exposure opt for 'safer choices', dropping smaller advertisers that may have a harder time proving compliance.
- Moreover, there is decreased availability of third-party data in the open internet market due to Google and Facebook no longer permitting third-party access to user IDs¹²⁰
-

The Court of Justice of the European Union (ECJ) ruled in July 2018 that Facebook, as well as operators of Facebook fan pages, are jointly responsible for how data is collected and processed.¹²¹ The decision is part of a legal dispute between the “Wirtschaftsakademie Schleswig-Holstein”, an education company, and the regional German data protection authority. The former operates a Facebook fan

¹¹⁴ Ryan, “Report from Dr Johnny Ryan – Behavioural Advertising and Personal Data.”

¹¹⁵ Olejnik, Tran, and Castelluccia, “Selling off Privacy at Auction.”

¹¹⁶ <https://whotracks.me/blog/gdpr-what-happened.html>

¹¹⁷ reach - Proportional presence across all page loads (i.e. if a tracker is present on 50 out of 1000 page loads, the reach would be 0.05).

¹¹⁸ site_reach- Presence across unique first party sites. e.g. if a tracker is present on 10 sites, and we have 100 different sites in the database, the site reach is 0.1.

¹¹⁹ <https://adexchanger.com/online-advertising/googles-gdpr-consent-tool-will-limit-publishers-to-12-ad-tech-vendors/>

¹²⁰ Stephen Adshead et al., “Online Advertising in the UK,” 2019, 110.

¹²¹ Judgement of the Court (Grand Chamber), Unabhängiges Landeszentrum für Datenschutz Schleswig-Holstein v Wirtschaftsakademie Schleswig-Holstein GmbH, case C-210/16

page on which it advertises business offers. Facebook provides the operators of such fan pages with anonymized data on the visitors to their pages. The court ruled that:

“The fact that an administrator of a fan page uses the platform provided by Facebook in order to benefit from the associated services cannot exempt it from compliance with its obligations concerning the protection of personal data.”¹²²

This ruling may have implications for advertisers in the context of programmatic advertising because they too may be accountable as ‘joint controllers’ for data that is processed in the RTB supply chain, and therefore risk liability as set out in Article 82 of the GDPR.¹²³

¹²² Ibid., paragraph 40.

¹²³ Johnny Ryan, “Europe’s Top Court Signals New Risk for Marketers from Ad Tech,” Brave Browser, July 15, 2018, <https://www.brave.com/blog/marketers-adtech-risk/>.

4. Policy-relevant questions and wider Societal Effects of Programmatic Advertising

The following section focuses on the effect that current programmatic advertising practices might have had beyond its immediate ecosystem. This is not an exhaustive overview of the wider societal effects of the programmatic advertising ecosystem. Nor are the following topics intended to be thorough examinations of the role programmatic advertising has had on the wider society. Instead, it simply aims to shed light on some of the alleged impacts the industry has had on society, based on a number of academic studies.. These topics may form the basis for future case studies as part of the algoaware project or may simply inform other researchers working in the domain.

4.1 Programmatic advertising: transparency of the ecosystem to consumers

There have been concerns raised about the way consumer data is used throughout the advertising ecosystem, specifically related to the breaches of user privacy. Estrada-Jimenez *et al.* illustrated these privacy risks when they examined a data set with the real ad-auctions of a DSP, and demonstrated that for at least 55% of the users tracked by the agency, it paid nothing for their browsing data.¹²⁴

Cabañas *et al.* estimate that sensitive user data held by Facebook on approximately 40% of the EU population can be exploited for advertising purposes.¹²⁵ In an attempt to improve the user experience and allay user concerns about privacy issues whilst increasing transparency Facebook introduced two transparency mechanisms in 2018:

- **“Why am I seeing this?” button:** provides users with an explanation of why they were shown a particular ad (ad explanations)
- **Ad Preferences Page:** provides users with a list of attributes Facebook has inferred about them and how (data explanations).

With this in mind, Andreou *et al.* conducted experiments where the authors created their own adverts and mapped user preferences to the explanations that were provided to investigate the level of transparency that these methods genuinely provided in practice. The authors conclude that the “ad explanations feature is often incomplete and sometimes misleading while data explanations are often incomplete and vague.” Moreover, the authors argue that “malicious advertisers may be able to obfuscate their true targeting attributes by hiding rare (and potentially sensitive) attributes by also selecting very common ones”. The authors have developed a tool called AdAnalyst that works in the browser when Facebook is open and provides additional explanations including some of the missing properties in a bid to move towards greater transparency.

AdFisher is another tool, developed by Datta *et al.* in their investigation into how user behaviour, either directly with browser settings or with content providers, alters the advertisements displayed to the user and whether these changes are aligned on Google Ad Settings.¹²⁶ For example, they found that setting the browser profile gender to female resulted in fewer instances of ads related to high paying jobs being displayed compared to when the gender was set to male. However, they were unable to determine the cause of these findings due to their limited visibility into the ad ecosystem, which

¹²⁴ José Estrada-Jiménez et al., “On the Regulation of Personal Data Distribution in Online Advertising Platforms,” *Engineering Applications of Artificial Intelligence* 82 (June 1, 2019): 13–29, <https://doi.org/10.1016/j.engappai.2019.03.013>.

¹²⁵ José González Cabañas, Ángel Cuevas, and Rubén Cuevas, “Facebook Use of Sensitive Data for Advertising in Europe,” ArXiv:1802.05030 [Cs], February 14, 2018, <http://arxiv.org/abs/1802.05030>.

¹²⁶ Datta, Tschantz, and Datta, “Automated Experiments on Ad Privacy Settings,” April 1, 2015.

includes Google, advertisers and websites. **The results of the experiment raise questions regarding transparency, fairness and accountability of the data and algorithms used to serve the advertisements.**

There are also a number of businesses that generate revenue primarily by providing cookie-based tracking of user data across vast networks of sites and by delivering embedded stories tailored to match the resulting algorithmically determined preferences of those users.¹²⁷ Companies such as Outbrain, nRelate, Taboola and Gravity provide sponsored hyperlink listings that can serve to drive users to content on the publisher’s own site or other sites, but, in both cases, the publisher of the original website profits as the referring party. These often appear as “Around the Web” or “Recommended For You” on the publisher page. **There are data-tracking and privacy concerns brought about by many of these third-party recommendation widgets given that they rely on tracking information from a users’ off-site browsing behaviour.**¹²⁸

4.2 Programmatic advertising: transparency of ad exchanges and ad placements

Advertising networks can be described as multi-sided markets, with different interests represented by each player under different configurations. Against the background presented in the previous sections of this report, an outstanding question emerges as to the meaningful transparency across the intricate chain of (algorithmic) processes emerges. Brand owners, advertisers and agencies claim further transparency (and control) over where their ads are placed, as well as further information – including personal data - on the consumers receiving the adverts. Publishers also require further transparency about the bidding process, and some claim higher revenues. At the same time, the interplay between the ad exchange and the data management platforms is not straight-forward.

As verification schemes are emerging, and large platforms are including third-party audits in their quality insurance processes, the policy understanding of the online advertising environment can benefit from a closer analysis of the economic checks and balances, and real-world practices ensuring some level of trust across the programmatic value chain.

4.3 Programmatic advertising: civic engagement

In a world where information available is unprecedentedly abundant, the use of programmatic tools for targeting individuals plays a cornerstone role in delivering information services and channelling information effectively.

As we have described above, the programmatic advertising ecosystem is currently predicated on the ability to obtain user data and target them with advertisements. This phenomenon has been utilised for commercial purposes but has also been exploited for non-commercial purposes – e.g. political advertising. Whilst the practice of microtargeting was first conducted during the 2002 Massachusetts US governor elections, the scale and precision of the practices have since become more sophisticated; the online advertising ecosystem has played a key role.¹²⁹ This appears to be having a mixed impact.

¹²⁷ “Native Advertising: Engagement, Deception, and Implications for Theory,” in *ResearchGate*, accessed February 27, 2019, https://www.researchgate.net/publication/281972887_Native_Advertising_Engagement_Deception_and_Implications_for_Theory.

¹²⁸ “Native Advertising: Engagement, Deception, and Implications for Theory,” in *ResearchGate*, accessed February 27, 2019, https://www.researchgate.net/publication/281972887_Native_Advertising_Engagement_Deception_and_Implications_for_Theory.

¹²⁹ Kathleen Hall Jamieson, “Messages, Micro-Targeting, and New Media Technologies,” *The Forum* 11, no. 3 (January 1, 2013), <https://doi.org/10.1515/for-2013-0052>.

Tailored messaging, or adverts, can be sent to subgroups of the electorate on the basis of the unique characteristics of the subgroup to build support for fundraising, campaign events, volunteering and ultimately motivating individuals to vote on election day. These practices are facilitated by the programmatic advertising ecosystem and may simply be viewed as an extension of older practices that are now occurring in the digital space.

However, there are concerns that in the context of civic engagement and algorithm-driven digital services, that are designed to maximise attention and addiction¹³⁰, individuals are not in control of the information they see but are instead presented with information that they have been categorised as 'likely to engage with'. Arguably, the programmatic advertising ecosystem facilitates a situation where a common objective reality between population subgroups is diminished, which in turn fosters civic discord.

Additionally, there are questions about whether the programmatic advertising ecosystem in its current format has contributed to the spread of misleading and false content, served to people with the intention of influencing political discourse and elections. This phenomenon has been labelled 'fake news' or 'online disinformation'¹³¹ and was widely reported to have occurred during the 2016 US presidential election.¹³² It has been demonstrated to be cheap and easy to perform on popular online platforms that offer the ability for granular "Detailed Targeting", for example on individuals that have made political donations.¹³³ It is argued that the advertising ecosystem establishes a much more direct economic link between the resonance and share-ability of individual articles and economic reward, thus creating incentives to propagate fake news.¹³⁴ Similarly, it can be argued that the current programmatic ecosystem also enables smaller publishers to thrive outside the ethical and self-regulatory constraints which in the past tightly reinforced an ethics of truth-seeking.¹³⁵

In-depth studies are however lacking as to the interplay between different media channels and social media information flows, demographically precise user behaviour or impact analysis. In particular, studies have struggled to show the effectiveness of social media targeting based on highly probabilistic models, and not plausible information as to the actual level of precision of such models have – e.g. the Kogan model used in the Cambridge Analytica scandal.

Numerous solutions to these issues have been proposed. The European Data Protection Supervisor has called for greater collaboration between data protection authorities, electoral regulators and audio-visual regulators to safeguard the rights and interests of individuals in the digital society.¹³⁶ Other potential solutions include: the development of codes of conduct for the advertising industry triggered by/encouraged by national parliaments; further development of industry-led mechanisms of fact checking and verification; a liability regime for intermediaries; and enhanced education of critical

¹³⁰ In current business models, advertising is sold automatically on the basis how many 'clicks' or views it will receive from a target demographic, thus the incentive for the platforms is to engage users to the greatest extent possible.

¹³¹ Joshua A. Braun & Jessica L. Eklund (2019) Fake News, Real Money: Ad Tech Platforms, Profit-Driven Hoaxes, and the Business of Journalism, Digital Journalism, DOI: 10.1080/21670811.2018.1556314

¹³² Kathleen Hall Jamieson, "Messages, Micro-Targeting, and New Media Technologies," *The Forum* 11, no. 3 (January 1, 2013), <https://doi.org/10.1515/for-2013-0052>. also see: Hunt Allcott, Matthew Gentzkow, and Chuan Yu, "Trends in the Diffusion of Misinformation on Social Media" (Cambridge, MA: National Bureau of Economic Research, January 2019), <https://doi.org/10.3386/w25500>.

¹³³ Larry Kim, "Facebook Ads, Fake News and the Shockingly Low Cost of Influencing an Election [DATA]," *Medium* (blog), October 11, 2017, <https://medium.com/marketing-and-entrepreneurship/facebook-ads-fake-news-and-the-shockingly-low-cost-of-influencing-an-election-data-ca7a086fa01c>.

¹³⁴ "How Advertisers Can Fight Fake News Instead of Funding It," *The Drum*, accessed February 28, 2019, <https://www.thedrum.com/opinion/2017/09/01/how-advertisers-can-fight-fake-news-instead-funding-it>.

¹³⁵ Damian Tambini, "Fake News: Public Policy Responses," n.d., <http://eprints.lse.ac.uk/73015/>.

¹³⁶ EDPS Opinion on online manipulation and personal data https://edps.europa.eu/sites/edp/files/publication/18-03-19_online_manipulation_en.pdf

media literacy.¹³⁷ In the Czech Republic, for instance, a 20-person unit in the Interior Ministry monitors threats including “disinformation campaigns related to internal security”. The unit also runs a Twitter account that advises on how to identify reliable news sources, promotes access to free media-literacy classes and occasionally announces specific information circulating online as untrue¹³⁸. Fake News legislation has been passed in France¹³⁹, Germany¹⁴⁰ and Italy.¹⁴¹

4.4 Programmatic advertising: news consumption

Digital advertising remains a critical source of revenue for most publishers, though they recognise that this will not be enough, on its own, to support high quality journalism.¹⁴² Business models across the industry are shifting so that consumers pay directly for online news through subscriptions, memberships, donations or per-article payments; mechanisms introduced as a means to safeguard higher quality content.¹⁴³ Growth of distributed content via social media and aggregators has been halted, whilst subscriptions are increasing in a number of countries. Though reader-generated revenue is increasing, it is often offset by continuing falls in print and digital advertising.¹⁴⁴ This is curious given that the global online advertising spend is increasing year on year, and perhaps demonstrates the relative importance of a small number of platforms in the online advertising space.

Despite the shift towards reader payment models, it is worth remembering that the majority of online news consumption occurs through free websites, largely supported by advertising (or through public subsidy). In the digital news sector, however, ad models continue to be undermined by low rates of return, and fraud.¹⁴⁵ The use of ad-blockers grew in 2017, alongside privacy browser extensions that allow specific advertisers to be blocked. More than four in ten (42%) now use blockers in Greece (+6% change from 2016) with significant increases in Germany (+5) and the United States (+4). Concerns and/or awareness about privacy-related issues with may be driving these changes.¹⁴⁶

Facebook remains the most important part of digital news publishers social media strategy and absorbs the clear majority of the resources allocated for social media distribution. Private sector legacy news organisations continue to use the platform because they are able to generate a short-term return on their investment and as while offering a way of pursuing their editorial ambitions and commercial objectives. This offers real opportunities though social media platforms themselves compete with news organisations for attention and advertising.¹⁴⁷ The maintenance of plural and sustainable media is associated with strong democratic systems.¹⁴⁸ As such, the extent to which the present programmatic advertising ecosystem has affected digital media consumption warrants further exploration.

¹³⁷ Tambini, “Fake News: Public Policy Responses.”

¹³⁸ Damian Tambini, “Fake News: Public Policy Responses,” n.d., <http://eprints.lse.ac.uk/73015/>.

¹³⁹ Zachary Young, “French Parliament Passes Law against ‘Fake News,’” *POLITICO*, July 4, 2018, <https://www.politico.eu/article/french-parliament-passes-law-against-fake-news/>.

¹⁴⁰ Staff and agencies, “Germany Approves Plans to Fine Social Media Firms up to €50m,” *The Guardian*, June 30, 2017, sec. Technology, <https://www.theguardian.com/media/2017/jun/30/germany-approves-plans-to-fine-social-media-firms-up-to-50m>.

¹⁴¹ Yasmeen Serhan, “Italy Scrambles to Fight Misinformation Ahead of Its Elections,” *The Atlantic*, February 24, 2018, <https://www.theatlantic.com/international/archive/2018/02/europe-fake-news/551972/>.

¹⁴² Nic Newman et al., “Digital News Report 2018,” *Reuters Institute*, 2018, 144, <https://reutersinstitute.politics.ox.ac.uk/sites/default/files/digital-news-report-2018.pdf>.

¹⁴³ Ibid.

¹⁴⁴ Ibid.

¹⁴⁵ Ibid.

¹⁴⁶ Ibid.

¹⁴⁷ Alessio Cornia et al., “Private Sector News, Social Media Distribution, and Algorithm Change,” September 2018, 43.

¹⁴⁸ Hannu Nieminen, “Media and Democracy from a European Perspective,” *Oxford Research Encyclopedia of Communication*, August 5, 2016, <https://doi.org/10.1093/acrefore/9780190228613.013.66>.

4.5 Programmatic advertising: discrimination in automated job advertising

The programmatic advertising ecosystem offers an efficient mechanism for companies who wish to advertise job opportunities. They are able to develop campaigns for suitable candidates by targeting advertisements to individuals on the basis of several variables, including, but not limited to, languages spoken, current job title or education history. Such targeting has the effect of including or excluding certain groups of people. Under certain circumstances, for example with gender-specific clothing, it may be desirable for advertisers to discriminate on the basis of gender. However, the principle of equality which follows that every individual should have the same opportunities includes equal access to employment.¹⁴⁹

Further legal analysis is necessary to assess to what extent – and what types of – discrimination in online advertising produce legally problematic effects. The following read requires further legal testing and case law research:

In fact, the Treaty on European Union (TEU) gives the EU competence to legislate in the area of non-discrimination¹⁵⁰, which it has, in particular, through Directive 2000/43/EC on Racial Equality, Directive 2000/78/EC on Employment Equality and Directive 2006/54/EC on Gender Equality. The substance of these three Directives covers discrimination in the field of employment based on race, ethnicity, sex, sexual orientation, religious belief, age and disability. Furthermore, EU law recognises the concept of both **direct discrimination** and **indirect discrimination**. The Gender Equality Directive defines ‘**direct discrimination**’ as follows:

“where one person is treated less favourably on grounds of sex than another is, has been or would be treated in a comparable situation”

Discrimination of this kind is most often linked to overt practice. Furthermore, distinctions based upon characteristics, which are inextricably linked to a protected characteristic, for example pregnancy, would represent an instance where direct discrimination has occurred. Thus, it might be concluded that instances of direct discrimination can be distilled down to whether certain persons included in the target audience would be able to see the advertisement if they did not possess a protected characteristic. In the context of job advertisements, this form of discrimination can be considered illegal because access to employment is protected by the Directives.

¹⁴⁹ J Clifford, ‘Equality’ in D Shelton (ed), *The Oxford Handbook of International Human Rights Law* (1st edn, Oxford University Publishing 2013) 428.

¹⁵⁰ Article 2 the European Union is founded on the values of respect for human dignity, freedom, equality, the rule of law, and respect for human rights. Article 3(3) TEU states that the Union will combat discrimination and promote equality between men and women. Article 10 of the Treaty on the Functioning of the European Union (TFEU) stipulates that the Union shall combat discrimination in defining and implementing its policies based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation. Article 19 TFEU confers the power to take legislative measures to combat discrimination to the Council after obtaining consent of the European Parliament.

The Directives provide a limited scope for when direct discrimination can be justified. The ‘**genuine and determining occupational requirement**’ (GOR) is as follows:

“a difference of treatment which is based on a characteristic related to sex shall not constitute discrimination where, by reason of the nature of the particular occupational activities concerned or of the context in which they are carried out, such a characteristic constitutes a genuine and determining occupational requirement, provided that its objective is legitimate and the requirement is proportionate.”¹⁵¹

In the context of online job advertisements, the application of the GOR is relevant to elements of the protected characteristic, as well as the protected characteristic itself. Furthermore, differentiation is permitted when the characteristic is directly related to the competence or suitability to the proposed role. The objective of GOR in each of the Directives is to ensure that differential treatment is legitimate and proportional. A key distinction is to be made between a GOR which is the requirement of the job, and the targeting of job advertisements, which is meant to theoretically provide the advertiser with the most economically efficient mechanism of reaching desirable applicants.¹⁵²

Indirect Discrimination is also a concept included in the Gender Equality Directive and is defined as follows:

“where an apparently neutral provision, criterion or practice would put persons of one sex at a particular disadvantage compared with persons of the other sex, unless that provision, criterion or practice is objectively justified by a legitimate aim, and the means of achieving that aim are appropriate and necessary”

Therefore, by this definition, indirect discrimination does not occur at all if the practice can be justified. Indirect discrimination does not occur when a campaign is intended to serve the business need by hiring people with a certain educational or professional background for example.

A neutral practice should be considered as not having regard for any protected, or equivalent of protected, characteristics. The concept of ‘particular disadvantage’ refers to cases in which members of a protected group are affected more adversely than others. Not being able to see the advertisement and thus not having the same opportunity to apply to a job is considered to be an adverse effect. The CHEZ case¹⁵³ indicates that there is no need to assess the seriousness of not being able to see a job advertisement, however, the detrimental impact of the practice needs to be assessed.¹⁵⁴ Thus, indirect discrimination can be said to occur when a neutral practice excludes a considerable larger percentage of a protected group compared to others.¹⁵⁵

¹⁵¹ Gender Equality Directive art 14(2); cf Racial Equality Directive art 4(1); cf Employment Equality Directive art 4(1).

¹⁵² David Jacobus Dalenberg, “Preventing Discrimination in the Automated Targeting of Job Advertisements,” *Computer Law & Security Review* 34, no. 3 (June 2018): 615–27, <https://doi.org/10.1016/j.clsr.2017.11.009>.

¹⁵³ CHEZ Razpredelenie Bulgaria AD v. Komisia za zashtita ot diskriminatsia, No. Case C-83/14 (2015).

¹⁵⁴ Christa Tobler, *Limits and Potential of the Concept of Indirect Discrimination* (Office for Official Publications of the European Communities 2008) 30.

¹⁵⁵ Dalenberg, “Preventing Discrimination in the Automated Targeting of Job Advertisements.”

CJEU case law determines that indirect discrimination can be objectively justified if the difference in treatment is based upon factors which are unrelated to any discrimination on the grounds of sex¹⁵⁶ and additionally must correspond to a real need on the part of the undertaking.¹⁵⁷ This offers guidance for determining whether the practice is legitimate, necessary and proportional.

In addition, the General Data Protection Regulation specifies (Article 22) conditions for the use of special categories of personal data – which include ‘revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation ’ (Article 9) in automated decision-making or profiling.

4.6 Evidence of job advertising discrimination in the programmatic advertising ecosystem

There are a number of mechanisms by which the programmatic advertising ecosystem may facilitate discrimination in the job market. The clearest cases occur when advertisers directly target persons of a special category when there is no legal justification for doing so. This is because online platforms, that allow advertising on user's pages, expressly enable job advertisers to target and exclude on the basis of special categories.

It is possible that advertisers may, for example, target a specific gender with a specific creative as part of a wider recruitment campaign that focuses on the whole population. However, it is also possible for advertisers to specifically target individuals based solely on the specific gender with no legal basis for doing so. Indeed, a recent ProPublica study appears to demonstrate that targeted adverts to either men or women on Facebook may have been discriminatory.¹⁵⁸ In August 2018, Facebook announced that, in the US, it would be removing 5,000 targeting options that could have been misused to place discriminatory ads on the platform.¹⁵⁹

In addition to the examples illustrated above, empirical evidence suggests automated algorithmic decision-making has the capacity to produce discriminatory outcomes in the context of job advertising, independent of human biases. A field test conducted by Lambrecht and Tucker concluded that across 191 countries, an advertisement for STEM jobs was shown to 20% more men than women.¹⁶⁰ Further, the finding was consistent across various online platforms including Facebook, Google, Twitter and Instagram.

The authors ruled out that the algorithm had learned the apparently discriminatory behaviour from actual consumer behaviour (i.e. if women were less likely to click on the ad, an algorithm trying to maximize click probability might be more likely to show the ad to men rather than to women). Instead, they found that women that were shown the advertisement were more likely to click on the ad than

¹⁵⁶ Case 170/84 *Bilka-Kaufhaus GmbH v Karin Weber von Hartz* [1986] ECR 1607, para 30; Case C-196/02 *Vasiliki Nikoloudi v Organismos Tilepikoinonion Ellados AE* [2005] ECR I-1789, para 47.

¹⁵⁷ Jeremy B. Merrill Ariana Tobin, “Facebook Is Letting Job Advertisers Target Only Men,” text/html, ProPublica, September 18, 2018, <https://www.propublica.org/article/facebook-is-letting-job-advertisers-target-only-men>.

¹⁵⁸ Dalenberg, “Preventing Discrimination in the Automated Targeting of Job Advertisements.”

¹⁵⁹ “Facebook Is Removing over 5,000 Ad Targeting Options to Prevent Discriminatory Ads,” *TechCrunch* (blog), accessed February 28, 2019, <http://social.techcrunch.com/2018/08/21/facebook-is-removing-over-5000-ad-targeting-options-to-prevent-discriminatory-ads/>.

¹⁶⁰ Anja Lambrecht and Catherine E. Tucker, “Algorithmic Bias? An Empirical Study into Apparent Gender-Based Discrimination in the Display of STEM Career Ads,” *SSRN Electronic Journal*, 2016, <https://doi.org/10.2139/ssrn.2852260>.

men. The authors discounted the possibility that the algorithm learned behaviour from other data sources that may have revealed a pattern of gender discrimination inherent in a specific country context.

Instead, the authors concluded that it is the mechanics and economics of real-time bidding within the advertising ecosystem that leads to this *unintended* gender discrimination.

The authors attempt to explain this phenomenon by highlighting the price premium that advertisers have to pay to deliver impressions to women (especially for women between 25-54). Marketing literature suggests women largely control household purchases, making them potentially more valuable targets for advertisers.¹⁶¹ Thus, as an exercise in profit-maximisation, advertisers of such products pay higher prices to deliver impressions to women, rather than men, as they are found to be more likely to click and make purchases.

The unintended consequence of the high economic valuation of women from actors in one industrial sector, spills over where it is both 'ethically' and 'economically' desirable to distribute the information regarding job opportunities equally across both genders. The paper states that:

“The key allocation mechanism that dictates the distribution of information is not a measure of the desirability of information dissemination, but instead is the return on investment on advertising across all industry sectors”

Similar findings were also reported by Datta (2015), who found that women were seven times less likely to see advertisements for an executive coaching service. However, in this case, due to a lack of transparency, the authors were unable to conclude which component of the advertising ecosystem was responsible for the discriminatory effects¹⁶².

Taken together, the results would point to the fact that real-time bidding in the context of advertising job opportunities may lead to **indirect discrimination** of one group in relation to another, in this case women. The algorithms appear to lead to unbalanced outcomes in the distribution of information because advertisers of other industries value women of a certain age more highly and are therefore prepared to bid more for their attention.

This is particularly significant as both EU policymakers¹⁶³ and industry leaders¹⁶⁴ have highlighted the importance of encouraging more girls and young women to take up STEM careers. Although it is still unclear whether and to what extent algorithmic decisions in the online advertising ecosystem perpetuate the apparent indirect discrimination of women in job advertising, in the interest of developing coherent policy approaches, policymakers should consider options for further investigation and potential policy approaches should action be deemed necessary.

¹⁶¹ Michael J. Silverstein and Kate Sayre, “The Female Economy,” *Harvard Business Review*, September 1, 2009, <https://hbr.org/2009/09/the-female-economy>.

¹⁶² Amit Datta, Michael Carl Tschantz, and Anupam Datta, “Automated Experiments on Ad Privacy Settings,” *Proceedings on Privacy Enhancing Technologies* 2015, no. 1 (January 1, 2015), <https://doi.org/10.1515/popets-2015-0007>.

¹⁶³ More women in the Digital sector: a key to Europe's successful digital future | International Womens Day 2018: <https://ec.europa.eu/digital-single-market/en/news/more-women-digital-sector-key-europes-successful-digital-future-international-womens-day-2018>

¹⁶⁴ Women in STEM: a cornerstone of Europe's digital economy: <https://blogs.microsoft.com/eupolicy/2018/04/25/women-in-stem-a-cornerstone-of-europes-digital-economy/>

5. Conclusions

This case study provides an overview of the programmatic advertising ecosystem. The provision of this overview has enabled the identification of a number of benefits where algorithmic decision-making in this context is providing a means to efficiently deliver creatives to users and drive economic growth of the online advertising sector. At the level of the individual there appears to still be a tension between the collection of user data, fundamental to the functioning of the programmatic advertising infrastructure in its current state, and the rights and protections of citizens in the context of personal data. It is still too early to understand the impact of the GDPR on the sector. The use of programmatic advertising has presented challenges to the industry itself with regards to advertising fraud, diminishing revenues for publishers, coalescing of influence around major online platforms, uneven adoption of industry standards (especially in the context of measurement and verification), and uncertainty regarding the effectiveness of advertiser investment. Further, the case study examines a few emerging issues such as news consumption and democratic elections and gender discrimination in job advertising, examined through the lens of programmatic advertising, and highlights some key findings in the field. These, and other emergent topics related to programmatic advertising, will require further examination but what seems to be clear is that the challenges and opportunities in the field can only be addressed through concerted collaboration between policymakers, industry and civil society.

algo:aware is procured by the European Commission and delivered by Optimity Advisors.

***algo:aware** aims to assess the opportunities and challenges that emerge where algorithmic decisions have a significant bearing on citizens and where they produce societal or economic effects which need public attention.*



www.optimityadvisors.com

www.twitter.com/optimityeurope

www.linkedin.com/company/optimityeurope

Study contact: Quentin Liger – quentin.liger@optimtyadvisors.com