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A Sociotechnical Exploration of Online Behavioural Tracking and Advertising Technologies and Practices

by

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As the Web evolved and extended to its current scale it has been driven by a range of divergent and competing visions about its constitution, purpose and future. The original vision of a global knowledge sharing system is now subsumed by a range of business models driven largely by monetising consumer data and metadata. Online Behavioural Tracking and Advertising (OBTA) constitute major business models underlying the Web today. Therefore, understanding OBTA and its future is critical to thinking about the future of the Web. However, lack of transparency in OBTA technologies and practices has made developing such understanding challenging. This thesis explores if and how a sociotechnical intervention can be imagined for systematic communication of operational details in OBTA. Informed by social theory and theoretical Science and Technologies Studies (STS), this exploration involves using the framework of speculative design to conceptualise a model for documenting and querying provenance of analytic and administrative operational details behind a targeted ad using software engineering methods and Semantic Web technologies, and conducting key informant interviews to explore if and how the model could be imagined to come to use, and provoke wider discussions. The research contributes to a sociotechnical understanding of OBTA and the dynamics of its present state that is required for a sociological future making for the Web.

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Chapter 1

Introduction

The history of the web is one of change. As the Web evolved from a speculative design (Berners-Lee, 1989) into its current form in use by over 4bn people, it has been driven by a range of divergent and competing visions about its constitution, purpose, and future. The original vision of a global knowledge sharing system;

> 'With the Web, we are sharing knowledge...' '...without discrimination as to who or where in the world you are' (Berners-Lee, 1993, pp.21).

is now subsumed by a web of business models, technologies, and practices that, can sometimes arrive with undesirable social implications, or raise critical questions and concerns that require investigation:

> 'The system is failing. The way ad revenue works with clickbait is not fulfilling the goal of helping humanity promote truth and democracy. So I am concerned.' (Berners-Lee quoted in The Guardian by Solon (2017))

The history of the Web goes back to 1989 when a new information management system was proposed by Tim Berners-Lee for the European Organisation for Nuclear Research (CERN), the particle physics laboratory in Switzerland (Berners-Lee, 1989). The proposed system aimed to improve the management and maintenance of CERN's large, complex and ever-growing information landscape, and enable sharing and accessing documents for particle physicists across the globe (Berners-Lee, 1989). At the heart of this conceptual proposal, was a hypertext system called 'Mesh', that later, with further development by Tim Berners-Lee, Robert Cailliau, Nicola Pellow, and others at CERN, was renamed the 'World Wide Web' (Berners-Lee, 1989; Berners-Lee and Fischetti, 1999).

Using the Internet, this information system has been supported by a set of open protocols, conventions, and software for writing, storing, naming, inter-linking, retrieving, and

rendering hypertext resources that could be navigated through a free software. However, the Web is co-produced by sociotechnical relations and is part of a bigger sociotechnical network, that require more than technical considerations (Berners-Lee et al., 2006). For example, public funding has been a key driver of the Internet from its conception to its global application (Mazzucato, 2015, pp.111), whilst on-going academic research such as developing and releasing Mosaic, a graphical web browser, has played a role in the adoption and the growth of the Web (Berners-Lee and Fischetti, 1999).[1] As a result, the social and economic milieu of the time, contingent historical developments, and technological design and development actively shaped each other and co-evolved together. As the Web grew, large amounts of interlinked hypertext pages, data, documents, and web technologies were created, providing the Web of Documents with an unprecedented potential as an information and communication medium and a platform for commerce.

Following the dot-com boom and bust of 2000, the Web of Documents went through major transformations in how it was imagined and used. The term 'Web 2.0' is often used to describes these transformations, including changes in business strategies of Web services, and the move towards user-generated content (Knorr, 2003; O'Reilly, 2005b). The sociotechnical processes involved, facilitated the production and distribution of 'amateur content' (Zuckerman, 2015, pp.134), and accommodated new technologies and business models that enabled sustaining the production and dissemination of content, technologies, and services on the Web. In this context, Online Behavioural Tracking and Advertising (OBTA) emerged as sociotechnical assemblages that co-evolved with the Web to become its key business models. For the purpose of this thesis, Online Behavioural Tracking and Advertising (OBTA) refers to a set of technologies and practices that collect and monetise data, and/or technologies and practices that enable targeting ads and content to specific probabilistic and/or deterministic demographic or psychographic attributes, and today constitute key business models underlying the Web.[2] OBTA technologies and practices have been used for monetising data and metadata for a wide range of purposes including generating revenue for sustaining the production and dissemination of content and services on the Web. The new technologies, practices, and business models with the support of their social and economic milieu, accelerated the growth of the Web content and services, affecting old, and co-creating new industries and markets that co-evolved with the Web.

Web Science is concerned with studying the relationship of the Web and society and their co-evolution over time (Halford et al., 2010). This is based upon a premise that technologies are co-produced by a range of human and non-human actors and are inseparable from their underlying social, economic and political context (Bijker et al., 1989; MacKenzie and Wajcman, 1999; Latour, 1987). This is applicable to the World Wide

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[1]Mosaic is a graphical web browser developed and released by the National Center for Supercomputing Applications (NCSA) at the University of Illinois at Urbana-Champaign (Berners-Lee and Fischetti, 1999, pp.74).

[2]For a more detailed definition of the term in this thesis and the rationale behind it see section 3.1.

Web: From its conceptual design and sociotechnical growth to its current scale, the social, political, economic and technical relations have co-produced the Web and co-evolved together. As a result, the nature of the Web is sociotechnical and not fixed or finished, but rather, ever evolving and contingent.

Building on a conceptualisation of the Web that considers it continuously co-produced by technology and society, this thesis starts from a premise that exploring concerns and questions surrounding the evolution of the Web and addressing them requires a sociotechnical understanding of the interplay of the heterogeneous actors that co-produce the Web. Today, Online Behavioural Tracking and Advertising (OBTA) comprise key business models underlying the Web and are therefore, a key consideration in the evolution of the Web. However, with regards to OBTA technologies and practices, such sociotechnical understanding is currently lacking.

A sociotechnical exploration of OBTA matters at least in two ways. It helps 1. investigating the social implications of OBTA that if not made visible and scrutinised, with the increasing integration of OBTA in the Web can get baked into the Web; and 2. exploring if and how OBTA assemblages in their current state encourage certain futures for the Web or exclude others. A sociotechnical exploration of OBTA is therefore needed for studying their impacts on individuals and social groups, as well as for experimenting with new ways of thinking about the future of the Web that offers potentials for opening new possibilities. This gap is the focus of this thesis. The following section details this further.

1.1 Statement of the problem

OBTA technologies and practices are increasingly used for collecting and monetising the interactions of individuals and groups with information online. As OBTA get more and more embedded in the production, distribution, and dissemination of online content and services, they increasingly become part of our daily online lives. However, OBTA can sometimes come with undesirable social effects, such as re-enforcing existing inequalities. Understanding these effects, and addressing them requires a sociotechnical understanding of the human and non-human actors that comprise OBTA, their contingencies, and their capacities and constraints for avoiding and treating undesirable social effects.

Concerns surrounding the direction of the evolution of the Web make investigating the relationship between OBTA and the Web as they co-evolve increasingly important. Such investigations are very challenging. OBTA technologies, practices, and their business models are not only shaped by a network of sociotechnical actors and their relations, but also are enabled and conditioned by the underlying political economy from which they cannot be separated. The complexity of the political, economic, social, and technical processes involved, makes determining causal effects of OBTA very challenging. However,

exploring the sociotechnical operations of OBTA and how the business models that they enable operate and are situated within the contingent historical and social context in which they evolve, can help investigating the dynamics of their co-evolution with the Web, and how they might contribute to encouraging or dissuading certain futures for the Web.

These points establish the need for a nuanced sociotechnical exploration of OBTA in order to understand the concerns and issues surrounding OBTA, both in relation to web users and the future of the Web. This exploration is the main aim of this thesis and starts with a broad overview of OBTA technologies and practices, and how they are co-produced by a wide range of technical, social, economic and political relations and co-evolve together. Following this, some of the key concerns surrounding OBTA from the previous theoretical and empirical research are explored. Since OBTA technologies and practices share similarities with other technologies and practices on the Web, the sociotechnical exploration of OBTA can benefit from the wider sociotechnical research. The thesis, therefore, to better understand the concerns, overviews the concerns surrounding a wider set of technologies and practices and the critical questions and debates surrounding their opportunities and risks.

This overview highlights the importance of investigating *when* and *where* data and algorithms can amplify existing social issues such as inequalities and contribute to undesirable social effects such as new forms of inequalities. However, this investigation is often very challenging: The overview also reveals growing concerns about lack of transparency (i.e.visibility) in data collection, analysis, and the uses to which those data are put (Pasquale, 2015).[3] For example, there are concerns on how people's daily activities are logged and used in ways that can have social and political implications whilst it is not clear how the data are used, decisions are made, and what are their consequences (Pasquale, 2015), leaving society in a state of 'technological unconscious'.[4] This lack of communication and consequently, the challenges in the way of researching concerns can be even more critical in the context of the spread of 'problematic information' (Jack, 2017) and 'media manipulation' (Marwick and Lewis, 2017), raising concerns that if and how OBTA could be exploited for anti-democratic purposes.

Mechanisms for transparency and communicating operational details can enable empirical research that can make issues surrounding the collection, processing and usage of data visible and inform public debate, whilst the absence of appropriate mechanisms for scrutinising technologies and practices means that discriminatory, unfair, and exclusionary practices could remain invisible, and potentially have a negative impact on trust.

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[3]For the purpose of this thesis, *transparency* and *visibility* are used interchangeably to refer to meaningful communication of operational details to different parties be it to the users, researchers, or governance bodies and policy makers.

[4]This term appears to be first used by Thrift (2004) in reference to Clough (2000)'s use of the term. Since then the term has evolved and applied to the context of algorithmic power, for example, by Beer (2009). The latter usage is intended for the purpose of this thesis.

As a result, there have been widespread calls for transparency, oversight, accountability, and appealing mechanisms (Citron, 2008; Crawford and Schultz, 2014; Pasquale, 2015; Kroll et al., 2017).

This has been followed by a wide range of responses that aim to investigate how safeguards, accountability, and redressing mechanisms could be devised, and ethical approaches to data and algorithms can be defined and encouraged. It is suggested that having transparency can facilitate this investigation. Therefore, a growing body of research explores approaches for enhancing transparency in processing and usage of data and operations of algorithms. However, devising mechanisms for transparency that can enable identifying, minimising, and treating undesirable social implications of data and algorithms is very challenging. Currently, there is a gap between the calls for transparency and their responses. Technologists sometimes find the demands for transparency detached from the technical affordances, and social scientists often find technology unable to account for the complexities of the social concerns at hand. In many cases, the responses to calls for transparency has been translated either into technical solutions, or broad public policy requirements/ recommendations for transparency. This leaves a gap between public policy and technology for a sociotechnical intervention for enhancing transparency in such a way that enables a better understanding the heterogeneous actors that co-produce OBTA and the concerns surrounding them. This includes not only investigating if and how problematic and best practices can be demarcated, but also, highlighting the more structural issues underlying them, as well as investigating how the social and the technical co-produce each other through generating heterogeneous relations some of which might not be desirable.

The lessons learnt from the wider literature are applicable to the domain of OBTA. Data, algorithms, and their surrounding issues are inseparable from their social and economic context. Many of the concerns surrounding OBTA technologies and practices such as concerns about group discrimination and exclusion are not new or specific to OBTA technologies and practices. Yet, these concerns are exacerbated in the context of OBTA due to lack of transparency in various areas of their technologies and practices that forms a major barrier in the way of exploring the concerns surrounding them. This risks rendering issues invisible.

Having transparency in OBTA can help better understand the concerns surrounding them, investigate when and where OBTA assemblages amplify the risks of undesirable social impacts, or co-create new issues and concerns, how risks can be minimised, if and how issues can be avoided and treated, and enabling such investigations can help moving beyond deterministic explanations and improve the state of public debate and trust. However, enhancing transparency in OBTA technologies and practices in such way that can help identifying and minimising undesirable social effects, remains a sensitive and challenging task.

This thesis takes the first step in this space. As part of a sociotechnical exploration of OBTA, it investigates if and how a sociotechnical intervention can be imagined for systematic communication of operational details for enhancing transparency in OBTA. This involves conceptualising a model for documenting and querying provenance of analytic and administrative operational details behind a targeted ad within the framework of speculative design and analysing qualitative research with stakeholders to explore if and how the model could be imagined to come to use. The research contributes to a sociotechnical understanding of OBTA and the dynamics of its present state required for a sociotechnical future making of the Web.

1.2   About this thesis

- This thesis starts from the position that OBTA technologies and practices are co-produced by sociotechnical relations. From this position, the thesis will claim that - in many cases, - the effects of OBTA rise not from purely technical or social reasons, but from the co-evolution of these heterogeneous actors and the contingencies that arise from this. Therefore, exploring, investigating and intervening in OBTA demands a thoroughly sociotechnical approach.

- To develop this approach, the thesis blends ideas and methods from different disciplines under the interdisciplinary umbrella of Web Science: It draws on the ontological, epistemological, and methodological approaches of sociology, computer science, and critical design but belongs to none of these disciplines. As a result, this thesis demands the reader to work across them. The additional burden on the reader caused by this approach is justified as a pragmatic compromise that enables experimenting with new ways of thinking about the future of the Web that offers potentials for opening new possibilities.

- This thesis started in 2014. Meanwhile, in the past few years (2016-2019), multiple events such as the US presidential election, UK referendum, Cambridge Analytica, various high profile scandals, and consequent concerns over media manipulation and the spread of problematic information, along with the GDPR and ePrivacy Regulation in the EU raised the attention of the popular media, governments and OBTA industry on related issues that significantly changed the dynamics of this research. The wider social and political context of this research has therefore, significantly changed. At the time of submitting this thesis in 2018, there are vast sociotechnical challenges to overcome for studying the heterogeneous actors that make the Web what it becomes. This thesis aims to contribute to one of these gaps, specifically in relation to OBTA.

1.3   Research rationale and questions

OBTA now constitute key business models for the Web, and investigating their technologies and practices is critical to thinking about the future of the Web. Based on an integrated STS theoretical approach, this thesis argues that this exploration must be sociotechnical. Therefore, the research question in this thesis is ***How can a sociotechnical understanding of OBTA be developed?*** Answering this question requires exploring answers to various sub-questions that are described in what follows.

The thesis starts exploring the answer to this question by investigating the social concerns and critical questions surrounding OBTA. Concerns surrounding OBTA include individual, group and wider social and, industry concerns. From a technical perspective, OBTA share similarities with other Web technologies and practices (e.g. recommender systems, personalisation, etc.). Therefore, developing a sociotechnical understanding of OBTA and the concerns surrounding it, can on the one hand benefit from, and on the other hand, contribute to, investigations in the wider domain. As a result, for a broader understanding of the concerns, relevant debates in the field of critical data and algorithm studies (Kitchin, 2014b; Dalton and Thatcher, 2014; Gillespie and Seaver, 2015) are explored.

The overview in the wider sociotechnical domain illustrates questions about the capacities of Big data for understanding the social world, and if and how they can affect our agency to define and know. There are also a wide range of concerns including claims to neutrality and objectivity of data and algorithms, concerns surrounding discrimination and exclusion, privacy harms, click/ad fraud, exploiting OBTA for spreading problematic information or anti-democratic purposes, and the impact of all of this on trust. Concerns might be due to problematic practices (misuse, inaccuracies and mistakes, fraudulent, or exploitative usage of OBTA) or, might be due to contingencies rising from the interplay of the sociotechnical actors that co-produce OBTA as they co-evolve together.

Based on the overview of the wider sociotechnical literature, the thesis argues that researching OBTA and their operational details is a key first step towards developing a sociotechnical understanding of their technologies and practices and investigating the concerns surrounding them. However, OBTA operations are often opaque, whilst their output (i.e. targeted ads) are often ephemeral, and only visible to their targeted groups. This makes lack of transparency in OBTA, a major barrier for empirical research on the concerns surrounding them, exploring ways to address them, and understanding their relationship to what the Web is becoming as they co-evolve together. It is therefore, asked ***How can transparency in OBTA operations be enhanced?***

From reviewing the history of previous interventions surrounding OBTA, it is then understood that transparency can be a red herring if used as replacement for safeguards to prevent unethical, unfair, and discriminatory practices, and mechanisms for treating

the problems. However, transparency is needed in addition to these, in moving towards understanding and addressing the concerns surrounding OBTA by facilitating research, including governance and regulatory research. Here, this thesis builds on a definition of governance that considers it as 'reflexive co-ordination' (Hofmann et al., 2017, 1414) and 'regulation research' as studying the impact and implementation of any public or private intervention including multistakeholder, legislation, and self-regulatory approaches for influencing the behaviour of others in the direction of a desired outcome (Hofmann et al., 2017, pp.1418). Therefore, it is asked ***How can transparency in analytic and administrative operations of OBTA be enhanced?***

As part of answering this question, this thesis explores the technical responses to calls for transparency, and from their history concludes that despite numerous attempts to raise meaningful transparency there is still a gap in practice. Based on a synthesis of the currently on-going debates surrounding algorithmic transparency and explainable algorithms, it is then argued that a systematic communication of operational details in OBTA can be more advantageous than discovering them, concluding that one way to fill the current gap on OBTA is to document the processes in a way that can be used for governance and regulatory research. This leads to a new sub-question. ***How can the operational details behind the analytic and administrative processes of OBTA be documented and communicated in an interoperable way across different actor groups?***

The processes involved in answering this question contribute to a sociotechnical understanding of OBTA needed for thinking about the future of the Web and OBTA. Within the framework of speculative design, a model is conceptualised in this thesis for documenting and querying the provenance of the analytic and administrative operations of OBTA, and it is investigated if and how it can come to use. As part of this exploration it is asked ***Can this model be imagined to be used? and if so, by whom? and how? and what are its promises and challenges?***

To explore answers, semi-structured interviews are conducted with OBTA stakeholders for their speculations about the affordances of the proposed approach to transparency for its imagined uses and users (e.g. individuals/academic and journalistic research, OBTA companies, governance bodies). Responses to if and how the model could be imagined coming to use, have been very diverse within and between stakeholder groups. The thesis suggests that the processes involved in conceptualising the model, and the data from the interviews, provide a rich sociotechnical account of the dynamics in the current state of OBTA that can inform sociotechnical future making for the Web. This raises a new question: ***How can this understanding be used for sociotechnical future making for the Web?*** The answer to this question is set to be explored as part of the future work.

1.4   Contribution

The main contribution of this thesis is in providing *a sociotechnical understanding of the interplay of OBTA technologies and practices through exploring an approach for enhancing transparency of the analytic and administrative processes of OBTA and investigating the promises and challenges of this approach.* This is pursued via making smaller contributions as follows:

- A sociotechnical intervention that involves proposing an approach for enhancing transparency in OBTA and discussing this approach with OBTA stakeholders. The thesis argues that the process involved in proposing this approach and discussing it with OBTA bares political value: It speculatively designs a model that conceptualises how OBTA actors could document and communicate their operational details. This speculative design intervenes in the current sociotechnical imaginaries whereby researching OBTA is a challenging and costly task that often requires reverse-engineering their technologies and practices.

- A new methodological approach that blends methods and ideas from speculative design, sociology and Semantic Web technologies to conceptualise a model for communicating, documenting, and querying the provenance of administrative and analytic processes in the pipeline of targeted advertising leading to a display ad, and engages with OBTA stakeholders to discuss the affordances of the model. This methodological approach has sociotechnical value as it enables creating a space for engaging across disciplines and stakeholders about the concerns surrounding OBTA, the affordances of the proposed approach, the affordances of transparency in moving towards addressing the concerns and experimenting with capacity-building for enhancing transparency. It is argued that a similar methodological approach could be applied for exploring the capacities for change in policy making in this domain.

- A new model for documenting and communicating OBTA operational details. The processes involved in designing the model have sociotechnical value in providing a big picture of the interactions and operations of OBTA technologies and practices.

- A qualitative analysis of participants' speculations about the affordances of the model and its promises and challenges for different stakeholders that has sociotechnical value in providing insights about the current dynamics of OBTA, and sociotechnical imaginaries at work that might be shaping current expectations about the future of OBTA and ultimately, the Web. It is argued that all of this can be used for imagining different futures for the Web.

Therefore, the thesis suggests that the process involved in designing the sociotechnical intervention and its methodological approach has value for better understanding the

sociotechnical facets of OBTA and for thinking about sociotechnical future making for the Web.

1.5   Outline

This chapter (Chapter 1) introduced OBTA as sociotechnical assemblages that have evolved to become key business model underlying the Web. It was suggested that the emergence of these sociotechnical assemblages, their evolution to their current state, concerns surrounding them about undesirable social effects such as exclusion or exacerbating inequalities, and their significance for the future of the Web require a sociotechnical exploration. This is expanded in the following chapters.

Chapter 2 provides a brief overview of the various theoretical approaches for exploring the relationship between society and technological innovation and development, as well as thinking about approaches for mobilising new forms of agency for driving positive change. The thesis is then positioned within these various approaches.

Chapter 3 provides a detailed overview of OBTA technologies and practices and introduces different types of tracking and targeting practices. Building on the work of others, this chapter suggests that multiple social, technical, cultural, and politico-economic relations have been mutually constitutive in the co-production of a new market on the Web for OBTA technologies and practices in ways that are inseparable from each other.

Chapter 4 draws on empirical and theoretical literature in the wider field of critical data and algorithm studies to contextualise the critical questions and concerns surrounding OBTA. Drawing on the empirical literature, examples of the concerns surrounding OBTA are discussed. In this new light, the importance of a sociotechnical exploration is once again emphasised. This time for thinking about approaches for enabling empirical research on the sociotechnical relations that constitute OBTA and the issues surrounding them. It is argued that this can not only inform public and policy debates, but also can help with re-building public trust. It is concluded that the lack of transparency in OBTA currently does not enable such research and is therefore, suggested that the first step towards enabling sociotechnical research on OBTA is to enhance transparency.

Chapter 5 aims to learn from the history of interventions how a mechanism for enhancing transparency that can enable empirical research and sociotechnical exploration of OBTA, might look like. Exploring the responses to calls for transparency in the wider context, points to a gap between calls for transparency and their responses. Based on this overview, the thesis argues that one approach for filling the gap could be to document and communicate the analytic and administrative processes. Applying this to OBTA, the research question is narrowed down to exploring an approach for documenting the administrative and analytic processes involved in the lifecycle of a targeted ad.

Chapter 6, applies the theoretical approach adopted in Chapter 2 to design a methodology for answering the research questions asked in this thesis in a way that engages with disciplines and stakeholders. This methodology involves an experimental approach that blends ideas and methods from sociology, critical design, and Semantic Web technologies to design a sociotechnical intervention for enhancing transparency in OBTA and explore its affordances, in such a way that pursues the main aim of this thesis which is to develop a sociotechnical understanding of OBTA.

This sociotechnical intervention consists of two parts. The first part draws on the concept of speculative design to critically design an approach for enhancing transparency in OBTA. This involves conceptualising a model called Targeted Advertising Tracking Extension (TATE) for communicating operational details in OBTA during a lifecycle of a targeted ad within the framework of speculative design and using software engineering methods and Semantic Web technologies. This conceptual model enables documenting and querying the provenance of analytic and administrative processes and decisions behind a targeted ad. The second part uses key informant and stakeholder interviews to engage with stakeholders to explore the perceived affordances of the model, and investigate its promises and challenges. It is drawn on the concept of sociotechnical imaginaries to explore incentives for transparency and understanding the current dynamics of OBTA ecosystem.

Chapter 7 describes the processes taken in designing TATE and presents a conceptual model for documenting the provenance of analytic and administrative decisions in the pipeline of a targeted ad. Initially, based on synthesising academic and grey literature on the operations of OBTA, a hypothetical OBTA scenario is described and its sequence of interactions are decomposed using UML diagrams. In the next step, requirements for documenting and querying provenance of an ad and the operational details behind its tracking and targeting processes are analysed. Following this, a data model for documenting and querying the activities, entities and agents abstracted from scenario is formed and presented. The data model is then mapped to W3C PROV due to best practice recommendations and interoperability. Examples of the generated graphs are provided that visualize OBTA operational details and templates extracted by identifying repeated provenance patterns. It is argued that similar templates can be adopted by each OBTA actor group to enable adopting the model to other scenarios. Finally, examples of queries are provided, demonstrating how the answer to a question from the requirements can be retrieved from the model, hence, validating the main requirements.

Chapter 8 explores the affordances of the conceptual model by conducting key informant interviews from the OBTA ecosystem. Participants' speculations about the affordances of the model are not only used for exploring the affordances of the model, but also, to discuss the current dynamics of OBTA. The analysis consists of four sections. Initially, the diversity of perceptions and underlying assumptions about concerns surrounding OBTA, and secondly, speculations about TATE's affordances (or no affordances) are explored.

Following this, the requirements of the model are revisited based on speculations from participants where adjustments were recommended. It is then argued that participants' speculations about TATE's affordances can provide examples of current sociotechnical imaginaries in OBTA that might shape current collective expectations about the future.

Chapter 9 argues that the processes involved in the two stages of the research in designing the model and the discussions that it provoked when interviewing key informants contribute to a sociotechnical understanding of OBTA. This chapter then sets the direction for future work to explore how this understanding might be used for a sociotechnical future making for the Web.

Chapter 2

Theoretical Approach

Scholars from various disciplines including history, sociology, geography, and philosophy have been exploring theoretical perspectives for understanding, explaining, and debating the relationship between society and technology (Law, 1987; Graham and Marvin, 1996; MacKenzie and Wajcman, 1999; Latour, 1987; Law and Mol, 2001; Hayles, 2006; Pinch and Bijker, 1984; Law, 1987; Haraway, 1987). The field of Science and Technology Studies (STS) is an interdisciplinary field that studies the relationship between society and technology and how they impact each other. A key premise of STS approaches is that technologies are co-produced by heterogeneous actors that are inseparable from their underlying social, economic and political context (Bijker et al., 1989; MacKenzie and Wajcman, 1999; Latour, 1987). Another premise of STS is exploring new approaches for reforming the technological processes to be more socially responsible (Sismondo, 2008, pp.18-20).

The broad epistemological and methodological approach taken in this thesis is informed by this interpretation of the role of STS. In what follows, a variety of approaches that could be considered relevant to studying OBTA are explored. This thesis is positioned against deterministic approaches, and in alignment with approaches of STS that consider technologies co-produced by various social, cultural, technical, and economic relations. In summary, similar to Graham and Marvin (1996); Kitchin (1998), and Van Dijck (2013), an integrated approach is adopted. This approach combines aspects of various STS approaches to 1. help understand the concerns surrounding OBTA and 2. experiment with if and how new forms of agency can be mobilised for enhancing transparency that can enable research on OBTA, for example, on where and when they can lead to undesirable social effects. This ultimately, aims to help explore if and how OBTA and the Web can co-evolve in such way that they do not facilitate, or re-enforce existing social issues such as inequalities, or the spread of problematic information. This aim therefore, remains consistent with the general goal of STS.

2.1   OBTA as sociotechnical assemblages

This section describes the context of the theoretical approach adopted in this thesis. Key theoretical approaches for thinking about the relationship between society and technology and intervening in them that can be considered relevant to the research question asked in this thesis are explored and reviewed, and it is detailed how aspects of some of them are combined as part of an integrated approach that frames the theoretical underpinning of this thesis.

In the first instance, deterministic approaches and those lacking nuance in accounting for both social and technical agency are critically reviewed, and the thesis is positioned against determinism and lack of nuance. For example, the thesis is positioned against theories that consider technologies the key driver of social change in ways that are inevitable, by drawing on STS approaches that argue that technologies are contingent, can be used actively and in reflexive ways, or can be re-appropriated to be used in ways that were not originally intended, instructed, or imagined at the time of their design.

Following this, the STS approaches, particularly those that consider sociotechnical agency are discussed. It is argued that exploring specific sociotechnical assemblages such as OBTA would require an integrated approach that combines aspects of various theoretical perspectives. The following section starts by a critical review of a range of theoretical perspectives for exploring the relationship between society and technology, and the STS approaches that emerged in response to them.

Theoretical perspectives for understanding and explaining the relationship between technology, and society are diverse (Graham and Marvin, 1996; Kitchin, 1998). STS theories in some cases arrived as a critique to some of these theoretical perspectives, and in other cases, built upon them. Theoretical approaches in STS include a wide range, from normative, to constructivist, and post-constructivist perspectives (Wyatt et al., 2016). As Wyatt et al. (2016, pp.90) note, STS approaches also vary in the way that their lenses are adjusted. Some focus on 'structural', and 'macrosocial phenomena.' Some focus on micro level sociological processes involved in the technological development, and others reject the assumption of scale underlying the micro/macro distinction, and instead, see technologies as part of a network of human, and nonhumans that are shaped by their wider relations. The following paragraphs start by an overview of the wider theoretical approaches, before detailing STS approaches that emerged in response to them.

Some of the theoretical perspectives on the relationship between technology and society can be criticised for lacking nuance. An example of such approach is futurism. Graham and Marvin (1996, pp.87), and Kitchin (1998, pp.56) describe futurism as one of the 'grand metaphor' approaches that aims to understand and explain technological innovation, and theorise change. They note that futurists can be technophile or reversionist,

and depending on this, futurism either considers technologies as solutions to ethical, social, economic, and political issues promising a new problem-free epoch, or romanticise a technology-free pre-industrialist lifestyle. The former may be considered relevant to 'solutionism,' a term used by Morozov (2014) to criticise a tendency to pose a problem as an urgent social issue that is then promised to be solved via a technological fix. A critique of futurism is that it offers a limited, and often exaggerated picture of the relationship between technology and society, whereby, technology leads to utopian or dystopian futures, neglecting how interaction of technologies with social, political, and economic forces can shape technologies in unexpected ways (Kitchin, 1998). This thesis is positioned against approaches such as futurism that lack the necessary nuances for considering the effect of historical contingencies, and social and cultural forces on the development and evolution of technologies that are necessary for exploring OBTA and the concerns surrounding them.

Another theoretical perspective for understanding the relationship between society and technology is the 'political economy' perspective, that emphasises the significance of politico-economic relations that contribute to the co-production of OBTA and new markets for their technologies and practices. However, this emphasis is sometimes at the cost of neglecting other social and cultural forces in this relationship. These different facets of this perspective are detailed further in what follows.

In the political economy perspective, technological innovation is seen to be embedded in the political economy to the point that it cannot go beyond the boundaries defined by its powerful structural relations (Graham and Marvin, 1996; Kitchin, 1998). In this approach, technologies are understood purely as a product of politico-economic relations and processes. These relations are considered key sources of agential capacity in the design, development, and usage of technologies, whilst technologies are believed to lack any agential potentials for producing the ways in which social processes are enacted (Kitchin, 1998). From this perspective, it is therefore argued that whilst technological developments enable improving the standards of living, they also reproduce the structural relations of the political economy (Kitchin, 1998, pp.59-60). On the one hand, this perspective highlights the impact of political economy on technological innovation and development on a macro scale. On the other hand, it neglects the influence of social processes and the role of culture in co-producing and re-appropriating technologies, their co-evolution together, and the contingencies rising from that in ways that can go outside the boundaries of the political economy (Kitchin, 1998).

This means that although aspects of this perspective help recognise the politico-economic relations that contribute to the co-production of OBTA and the Web and the concerns rising from them, its other aspects tend to undermine the social forces and contingencies that can change how technologies are enacted and evolved, neglecting the role of cultural and social forces in re-appropriating the structural politico-economic relations. This makes it unhelpful for investigating potentials, and exploring approaches for making the

necessary critical interventions. For example, when looking for alliances that can mobilise social and cultural forces for investigating and addressing the concerns surrounding OBTA.

Another theoretical perspective that is concerned with the relationship between society and technology is technological determinism. Technological determinism is often described as an approach based on the notion that technologies have causal relationship with social change in ways that are inevitable (Graham and Marvin, 1996, pp.83); (Kitchin, 1998, pp.57) and drive cultural values and shape the social without being influenced by them (Grint and Woolgar, 1997). Technological determinism is based on a premise that, 'technological developments take place outside society' (Wyatt, 2008, pp.168), and technologies impacts society 'from outside of society' (MacKenzie and Wajcman, 1999, pp.5).[1]

As Baym (2010, pp.25) points out, the history of technological determinism goes back to concerns about the invention of alphabet and its threats to the Greek oral tradition (Ong and Hartley, 2012). Examples of technologically deterministic arguments today can be seen surrounding the fears of moral decline surrounding the new media (Baym, 2010, pp.41). Baym (2010, pp.24-25) provides examples of technologically deterministic views surrounding the Web, for example, on claims that Google is 'making us stupid', or Facebook is able to 'enhance intelligence.' Meanwhile, drawing on Smith and Marx (1994), Wyatt (2008) delineates different types of technological determinism, noting that its varieties range on a spectrum from 'soft' to 'hard,' that can, not only manifest themselves in a form of solutionism, but also, in the form of a 'pessimistic' critical theory of technology (Wyatt, 2008).

On the one hand, the concerns about the impact of technology on the social can be considered 'valid' (MacKenzie and Wajcman, 1999, pp.40-41). On the other hand, considering technologies as causal reasons for social change is problematic. Technological deterministic accounts of technological innovation and change tend to depict hyperbolic 'powerful scenarios', and 'clear stories' that oversimplify the contingent historical, and social context of technologies (Graham and Marvin, 1999, pp.91). These aspects can be explored further in the work of Winner, and the debates surrounding it.

Winner (1980) explored the politics of artefacts, by focusing on the design choices made by their designers over time, and how the design of an artefact might lead to a fixed 'set of consequences' (Winner, 1980, pp.109-125). More specifically, Winner (1980) explored the works of Robert Moses, an architect in New York, suspecting if Long Island Parkway underpasses were consciously, or subconsciously, designed with low height in a way that prevented buses from passing under them, leading to discrimination, and exclusion of social groups from access to public beaches. Winner (1980)'s theory on the bridges

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[1] Wyatt (2008) notes that Marx is often mis-characterised as a technological determinist, but this assertion has been refuted by MacKenzie (1984) amongst others. For details see MacKenzie (1984).

was eventually refuted on strong grounds (see Joerges (1999), and Woolgar and Cooper (1999)). Additionally, Winner's approach was criticised for an intentionalist reading of the bridge story, scapegoating Moses (Joerges, 1999), and for the inadequacy of the theories of control for explaining social change that oversimplify the interplay between technology and society into a binary focus on intention and unintended consequences (Slota and Bowker, 2017, 533). Woolgar (1993) suggests that social phenomena could be understood as interlinked actions and their consequences, that the result of their interplay as they evolve might not be intended, and is understood differently by different actors, and this understanding is also subject to change. Slota and Bowker (2017, pp.534-535) note that, according to Joerges (1999), a discourse of contingency such as one seen in the work of Woolgar (1986), tends to see

> '... social order, and disorder as a result of the confluence of a variety of consequences of many small actions. Each action is intentional, but the result, for all intents, is blind–coming from many independent actors making sense as best as they can.'

Based on such understanding of the discourse of contingency, Joerges (1999) suggests that the such discourse underlying Woolgar (1986)'s critique of Winner, itself is guilty of over-simplifying the sociotechnical complexities at play (Slota and Bowker, 2017, pp.534-535). Joerges (1999, pp.423) suggests that, the most real account of the bridge story might therefore, be lying 'somewhere between the grand discourses of control, and contingency.' However, Woolgar (1993)'s critique of Joerges (1999)'s critique is that, Joerges (1999) is still chasing the intentions behind Moses's actions instead of following the changing effects of the story and its changing interpretations.

As Slota and Bowker (2017, pp.534) note, both of these discourses are very important in relation to critically studying the Web, data and algorithms. However, the underlying assumption in technological determinism that the social, or political implications of technologies could be determined, can be problematised. Technological determinism neglects that the social relations can influence technological artefacts, and that this continues in the lifetime of technological innovation from design to usage, making technologies differently understood, re-interpreted, and re-appropriated (Bijker et al., 1989; Kitchin, 1998). This is not to say that we should dismiss the question on investigating the impact of technical on social capabilities. In other words, as Law (1992, pp.383) describes:

> '...artefacts may, indeed, have politics. But the character of those politics, how determinate they are, and whether it is possible to tease people, and machines apart in the first instance– these are all contingent questions.' (Law, 1992, pp.383)

This is applicable to the context of this thesis in exploring OBTA and the concerns surrounding them. Exploring the emergence of OBTA and its co-evolution with the Web

towards its current significance as key business models for the Web requires considering historical contingencies, and the cultural, social, technological, economic and political relations involved. Deterministic perspectives do not account for contingencies and are therefore, excluded from the approach of this thesis. However, despite the problems of technological deterministic theories, the focus of concern on if, and how political assumptions and values are embedded in the artefacts, and if and how artefacts can impact our social and political capabilities, remain a crucial and important inquiry (Slota and Bowker, 2017). Such concerns can be helpful in this thesis for posing questions on the assumptions underlying OBTA technologies and practices and their potential social and political implications in different social contexts.

On a spectrum with technological determinism on one end, theories of the social construction of technology are at the other end. The Social Construction of Technological Systems (SCOT) has its roots in SSK and was born from a critique of technological determinism. Sociology of Scientific Knowledge (SSK) considers the technoscientific method and practice as 'disciplinary cultures', and that 'methods cannot be separated from their social context' (Law, 2017, pp.33). As a result, many STS approaches adjust their lenses to micro-sociological processes of science, and technology using observational methods (Wyatt et al., 2016, pp.90).[2]

Meanwhile, Pinch and Bijker (1984), the STS researchers associated with SCOT, found the constructivist approach helpful as a 'starting point' (pp.400) for thinking about the relationship between technology and society. Instead of theorising change by taking the technological innovation outside of their social context, SCOT rejects technological determinism by avoiding reducing change to oversimplified stories, and the notion of the inevitability of social change caused from technological development. Instead, SCOT considers technologies to be resulted from social processes and account for contingencies that might change how technologies evolve (MacKenzie and Wajcman, 1999).

SCOT applied a sociological perspective in explaining technological artefacts often using case studies, shifting the attention to the contingent context of technological change by highlighting that technological innovations are highly reliant on the social. Bijker et al. (1989, pp.28) argued that different 'relevant social groups' can understand the same technology, judge its functionality, and define 'problems' surrounding it in different ways. They suggested that technologies cannot be understood without their 'end-users', and the 'cultural ambiance' in which they operate (Bijker et al., 1989, pp.337). Therefore, understanding technologies requires considering the social contexts in which technologies are situated in, and their contingent effects. They draw attention to the 'interpretive flexibility' (pp.20) of the artefacts, their stories, and their effects (Bijker et al., 1989; Aibar and Bijker, 1997), the 'closure' of the technology, and its meaning into a stable form (Bijker et al., 1989, pp.250), and how society might adjust itself to them. For example, Bijker et al. (1989) explored the social and cultural forces underlying the appeal

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[2]For this, Wyatt et al. (2016) bring the example of the work by Collins (2004).

and popularity of Penny-farthing bikes to particular social groups in Victorian Britain, and how a combination of social relations contributed to the creation, and successful adoption of the safer, and more inclusive modern bicycles. SCOT and similar perspectives emphasised the impact of social relations on the artefacts (MacKenzie and Wajcman, 1999). However, more broadly, social constructivist account of technology neglected the valid aspect of technological determinism that paid attention to the impact of technical on social (MacKenzie and Wajcman, 1999, pp.40-41).

In this thesis, aspects of SCOT are applied in thinking about the evolution of the Web and OBTA. For example, elements of SCOT such as interpretive flexibility, and closure help explore how certain Web technologies (such as cookies, Flash LSO, and HTML5) were re-appropriated to become key element of OBTA technologies and practices on the Web. More broadly, SCOT can help thinking about the role of culture in the co-production and co-evolution of the Web and OBTA towards a point where OBTA became a key part of business models for the Web. SCOT also helps exploring how concerns and issues surrounding OBTA technologies and practices are defined, understood, and prioritised differently, by different OBTA actor groups. More broadly, these aspects of SCOT are applied for rejecting deterministic explanations about the causal relationship between web technologies and social change. However, SCOT comes with shortcomings that require further attention. These are detailed in what follows.

The first shortcoming of SCOT is that in identifying relevant social groups, there is a risk of 'structural exclusion' of groups that have not been historically mentioned to be linked with the artefact (MacKenzie and Wajcman, 1999, pp.39). The second issue, is more broadly, neglecting the influence of technologies on social relations (MacKenzie and Wajcman, 1999, pp.40) that has been mentioned earlier.

In response to these shortcomings of SCOT, Social Shaping of Technology (SST) arrived as a 'middle ground' (Baym, 2010, pp.44) between technological determinism and social construction of technology that highlights the mutual relationship between society and technology (MacKenzie and Wajcman, 1999). SST intentionally used the metaphor of 'shaping' instead of 'social construction' as the latter is 'too prone to misconception that there was nothing real and obdurate about what was constructed' and mis-characterisation as relativism (MacKenzie and Wajcman, 1999, pp.32). SST draws attention to the path dependencies of technologies, and the social relations that influence technological change where 'there is no single dominant shaping force' (pp.29), emphasising that society and technology are mutually constitutive (MacKenzie and Wajcman, 1999, pp.46). Instead, the consequences of technologies are considered to stem from 'a mix of affordances- the social capabilities technological qualities enable-' and the contingencies from their intersection with social and cultural forces, that mean they can be re-appropriated in unanticipated ways (Baym, 2010, pp.44).

This perspective is applied in exploring OBTA in this thesis to consider OBTA constitutive of heterogeneous actors that co-produce OBTA and co-evolve together. Applying SST to the concerns of this thesis would mean paying attention to the affordances of OBTA as they interact with various social contexts, and exploring if and how they could effect how they are practiced and used on the Web that can have social, economic, and cultural implications. Meanwhile, whilst SST offers a nuanced lens for considering the mutual relationship between technology and society, and recognising the short-comings of SCOT and the constructivist approaches, yet it does not suggest how agency of these heterogeneous actors can be mobilised for addressing the concerns and making the necessary critical interventions (MacKenzie and Wajcman, 1999, pp.40). The following section aims to fill this gap by exploring approaches for moving towards addressing the concerns.

2.2   Accounting for sociotechnical agency

This section introduces key STS theoretical approaches relevant to exploring OBTA that can be considered as third alternatives to the binary choice between technological determinism and social constructivism, or theories of contingency and control, and can potentially be used to emphasise the relational nature of agency. A brief overview of some of these relevant approaches is provided in what follows, and it is argued how they can help exploring OBTA technologies and practices and making the necessary critical intervention in their co-evolution with the Web.

Actor-Network Theory (ANT) (Latour, 1987, 2005) rejects the premises underlying the micro/macro distinction (Wyatt et al., 2016, pp.90), and holds that for technologies to function as planned, they are reliant on networks of human and nonhuman actors that are shaped by their relations (Latour, 2005). ANT sees the world as networks consisting of human and non-human actors that co-produce and co-construct each other, and the world in which they are. In this sense, technologies are continuously shaped by sociotechnical processes, and the agents involved in this co-production are not separable from each other. Moreover, this approach considers objects, and subjects in a mutual relationship that co-produce each other, making agency relational and sociotechnical. For ANT human agency is not considered more important than nonhuman agency, and intentionality is 'borrowed', and 'distributed' (Latour, 2005, pp.46). As Suchman (2007, pp.286) describes,

> 'The point in the end is not to assign agency either to persons, or to things, but to identify the materialization of subjects, objects, and the relations between them as an effect, more, and less durable, and contestable, of ongoing sociomaterial practices.'

A common critique of ANT has been the lack of weight between human, and non-human agency that is important for thinking about accountability, and the politico-ethical implications of technologies (Introna, 2009). In response to this, Suchman (1998, pp.8) suggests developing 'a discourse that recognizes the deep mutual constitution of humans, and artifacts without losing their particularities.'

Theories of 'co-production' (Jasanoff, 1996) are influenced by ANT. Co-production is more used for 'understanding subjectively how things fit together' than 'explaining objectively how things come to be as they are' (Jasanoff, 2015, pp.3), often emphasising the simultaneous nature of co-production (Jasanoff, 1996) (Guston, 2001, pp.401). Additionally, it can be argued that co-production can be performative. This comes from a notion that the objects are not 'fixed', or finished, but are enacted, and are therefore, shaped differently. As a result, different practices make different objects (Mol, 2002; Law, 2017). This means that objects, and practices are sometimes better understood in the context of their enactments. Therefore, it is sometimes suggested that if the focus of the research is on 'process,', and 'continuing process' then instead of production it might be better to think in terms of 'performance or enactment' as 'the webs of relations only hold if they are enacted' (Law, 2008, pp.635).

Latour (1999) also highlights this performativity in exploring postconstructivism. In response to the critique of dichotomies of realism verses relativism, the binary arguments that technological innovation occurs outside society versus seeing it purely constructed by society, and the binary choice between technological determinism versus social constructivism, Latour (1999) proposes a more 'realistic realism' (pp.15) based on rejecting these dichotomies and arguing that the assumed gap between humans, and the 'world outside' (pp.6) never existed and the debates are misplaced (pp.96). Applying this perspective to the context of technological development, can mean that humans can never be separated from technologies that they develop; that there is no a priori division between the social, and the real, and that they are instead inseparable. As a result, technologies are not purely created by society nor nature, but rather, they can be understood as the outcome of multiple sociotechnical translations.

The theoretical perspectives introduced above can be applied to account for sociotechnical agency, and co-production of society and technology. The emergence of OBTA, the Web's over-reliance on them today, and concerns surrounding them can be considered resulted not purely from technical or social relations, but rather, co-produced by sociotechnical relations that are part of a wider sociotechnical network. Recognising this sociotechnical agency is not only useful for analytic descriptions, but also in thinking about how this agency can be mobilised to make the necessary critical interventions. For example, the concept of co-production can be employed not only as an analytical lens for exploring the 'interplay of structure, and agency' (Jasanoff, 2012, pp.439-440), but also to go beyond the critique and in informing the way towards addressing the concerns (Jasanoff, 2010, pp.284). This is further detailed in what follows.

According to Wyatt et al. (2016, pp.91), STS moved beyond SSK and towards postconstructivist or 'critical and cultural studies of science and technology' (Hess, 1997, pp.85) with their roots in queer, feminist, postcolonial, and cultural studies. A key theme here with regards to technologies is the critical notion that epistemological, ontological, and methodological assumptions about race, gender, and indigeneity amongst others can be embedded in the technological design and development that, re-enforce existing structural inequalities in ways that indicate that the social benefits of technological development are not equally distributed to everyone (Subramaniam et al., 2017, pp.408-409). These critical approaches challenge the underlying assumption that technological innovation occurs outside the social, and the subsequent universal claims that, technologies could be considered neutral, and value free. STS works in this area include a wide range. For example, as Jasanoff (2017, pp.267-268) notes, within feminist technology studies, some of the work in this space warned that when technologies are offered as solution to fix gender inequalities, they might instead exacerbate the existing issues (Cowan, 1985), and some highlighted the under-representation of women's perspectives in the technological design, and development (Subramaniam et al., 2017).

Amongst the approaches within feminist technology studies, some argued that the critique by itself is not enough, and that a necessary part of the critique is to open up spaces for change and make the necessary critical interventions and enable improvements and repair, that makes them very relevant to this thesis. 'Situatedness' (Haraway, 1988), and 'strong objectivity' (Harding, 1993) strongly rejected the relativist misconceptions, and instead, highlighted the relational nature of agency. In the context of technological innovation and development this can mean situating technologies in their historical conjunctures, and being reflexive about the underlying assumptions that find their ways in, without rejecting technologies and their benefits. Such reflexivity can make technologies and practices attentive to the concerns of different social groups, and build a capacity to care and the ability to respond to the concerns surrounding them. These theoretical perspectives are detailed further in what follows.

Haraway (1991) builds upon a premise that emphasises the embodied nature of technoscientific method, and practice:

> 'The machine is not an *it* to be animated, worshipped, and dominated. The machine is us, our processes, an aspect of our embodiment. We can be responsible for machines; *they* do not dominate, or threaten us. We are responsible for boundaries; we are they' (Haraway, 1991, pp.180)

She then continues by clarifying that the emphasis on the social, does not mean refusing the technical, and that, a pre-requisite for this reflexivity is working across the boundaries. She criticises the purist views that reject technology for returning to what

is considered more 'natural' and instead, argues for embracing technologies and mobilising the potentials that comes with their unfixed and contingent nature (MacKenzie and Wajcman, 1999, pp.6). She suggests:

> '...taking responsibility for the social relations of science, and technology means refusing an anti-science metaphysics, a demonology of technology, and so means embracing the skilful task of reconstructing the boundaries of daily life, in partial connection with others, in communication with all of our parts.' (Haraway, 1991, pp.181)

Applying Haraway's works to exploring the relationship between society and technology, it can be asserted that being critical of aspects of technological development should not equate, -and does not mean- rejecting technologies. Similarly, Harding (1993)'s 'standpoint theory', as she suggests, '...does not advocate -nor is it doomed to- relativism' (pp.61). Instead, she also calls for reflexivity, noting that:

> 'Strong objectivity requires that the subject of knowledge be placed on the same critical, causal plane as the objects of knowledge. This, strong objectivity requires what we can think of as "strong reflexivity."' (Harding, 1993, pp.69)

Moreover, further inspirations can be taken from Haraway's concept of 'staying with the trouble' (Haraway, 2016, 2018) that although belongs to a different context, can help considering the importance of cross-disciplinary and cross-actor group engagement and capacity building as part of designing interventions. Haraway uses this concept in the context of multi-species environmental justice to emphasize the importance of exploring new ways of thinking about and engaging with the world, understanding the world as interconnected, and cultivating new links, and the necessity of this engagement and capacity building under political conditions that make investigating, and addressing ecological and environmental problems challenging (Haraway, 2018, pp. 102).

Haraway suggests that in these conditions it is crucial to focus on 'inventive practices' as opposed to 'game-over cynicism' (Haraway, 2018, pp. 102), and collaborate across fields and disciplines and engage with each other to cultivate practices of response to the problems. The slogan 'staying with the trouble' is Haraway's way of suggesting that at the time when political conditions are such that certain conditions might seem inevitable and moving forwards might seem difficult, becoming a 'we' that is capable of responding to the problems of this world requires creating the capacity for 'response-ability,' and the capacity to care. This capacity building involves ongoing engagement, 'thinking-with,' not relying on totalising remedies that can trigger unthinking, and instead maintaining situated questioning, and ongoing creative work together (Haraway, 2018, pp. 102-104). It requires caring for the 'forced displacements, political oppressions, permanent wars,

and so on,' (Haraway, 2018, pp. 104) 'thinking-with' each other about these stories, risk being wrong, and cultivating meaningful responses to each other (Haraway, 2018, pp. 104-105). In describing Haraway's notion of developing 'response-ability' as a means of staying with the trouble Reardon et al. (2015, pp.12) suggest:

> ... This work marks a shift from an ethics figured as individual responsibility to an ethics of 'response-ability' (see especially Barad, 2007; Haraway, 2008; Schrader 2010, 2012). More than a clever play on words, response-ability, Donna Haraway argues, is not about aligning one's actions with a set of universal ethical principles. Instead, it requires cultivating practices of response. These practices are developed and done with others, both human and non-human, in a process of ongoing exchange. (Reardon et al., 2015, pp.12)

Haraway calls for forging new ties and promises across disciplines, and continue experimenting with and inventing new ways of thinking about intervening (Haraway, 2018). Inspired by various works of Haraway and in particular, the notions of 'situatedness' and 'staying with the trouble,' this thesis argues that despite the potential tendency for technological fixes and solutionism (Morozov, 2014), technology could be part of the process. Whilst the context in which Haraway's 'staying with the trouble' is set is very different from the context of this thesis, the concept can help in thinking about how to build capacities for positive change, across disciplines and actor groups.

The above approaches are used in this thesis for moving beyond the critique and explore if and how necessary critical interventions can be made with regards to the concerns surrounding OBTA. Inspired by them, the thesis acknowledges the critique of the business models underlying the Web and explores approaches for adding reflexivity to the OBTA processes. Also, when exploring approaches for enhancing transparency in OBTA, these theoretical inspirations help in thinking about ways to design mechanisms for transparency that can overcome the epistemological differences between the fields currently involved in responding to calls for transparency, that sometimes mean that the technical is often not as critical, and on the other hand the critique can sometimes be too harsh, leading to a sense of collective defeatism. These theoretical inspirations allow instead, to experiment with capacity building across disciplines and stakeholders.

2.3   Conclusion: An integrated approach

This chapter provided an introduction and review of the approaches that could be considered relevant to exploring OBTA, the concerns surrounding them, and thinking about approaches for making the necessary critical interventions. The deterministic approaches

were critically reviewed, and this thesis was positioned against them. For example, technological determinism considers the relationship between technology and society determined by technical relations, neglecting the role of human agency and the social forces on technologies.

It was noted that scholars have sometimes drawn on aspects of various theoretical perspectives to create integrated approaches. For example, Graham and Marvin (1996) combine aspects of social constructivism and political economy to explore the geography of telecommunications. Kitchin (1998) combines aspects of various theoretical perspectives to account for the heterogeneous relations that constitute cyberspace. And Van Dijck (2013) combines ANT and a political economy perspective to explore social media, by paying attention to six areas of technology, usage/user, content, ownership, governance, and business model (Kaun, 2014, pp.196). In a similar approach, this thesis draws on an integrated approach by combining and assembling elements from the various theoretical perspectives introduced in this chapter. The integrated approach of this thesis consists of 1. an SST framing for exploring the emergence of OBTA and their evolution towards key business models for the Web, and understanding the concerns surrounding their technologies and practices. 2. combining ANT, theories of co-production, and various works of Haraway for exploring ways for cultivating capacities of positive change across disciplines and actor groups.

Using this approach, the thesis starts from the premise that the history of the Web is one of change. The Web consists of a dynamic network of heterogeneous actors (Latour, 2005; Halford et al., 2010; Tinati, 2013) and is continuously co-produced and re-produced by different competing, and aligning interests. This makes the Web both contingent and performative and not a fixed outcome, but rather, dependant on the multiple forces that drive its evolution. Building on this, as mentioned in chapter 1, the thesis suggests that the effects of OBTA rise not from purely technical or social reasons, but from the co-evolution of heterogeneous actors and the contingencies that arise from this. Therefore, the issues surrounding them cannot be tackled based on an isolated social or technical understanding of those issues, and exploring, investigating and intervening in OBTA demands a thoroughly sociotechnical approach.

On a spectrum with technological determinism on the one end and social constructivism on the other end, the approach of this thesis is therefore, positioned somewhere in the middle. This positioning helps avoid singling out one dominant force as the causal reason, and instead, considers multiple inseparable social, technical, cultural and politico-economic relations that mutually shape each other as they co-evolve together. In this sense, the wider frame of this approach is aligned with SST. Meanwhile, within this SST framing, the concerns of the other approaches are not dismissed. For example, the role of structural politico-economic relations in the emergence and evolution of OBTA along the Web and some of the concerns surrounding them is acknowledged. Yet this is not applied as a deterministic explanation of change, that undermines the role of cultural and

social forces in technological innovation, development and how technologies are used, re-appropriated and evolved. Similarly, aspects of SCOT are used as a reminder of the role of cultural and social forces in the co-production and co-evolution of OBTA and the Web. As a result, the SST framing is used to draw attention to the affordances of OBTA, and how concerns can arise from these affordances as they intersect with social and cultural relations, that can for example, accelerate some patterns, and amplify certain existing cultural and social issues. Additionally, this helps considering the OBTA market co-produced by a myriad of politico-economic, sociotechnical relations, and public, and private forces.

Based on such understanding OBTA as sociotechnical assemblages, it can then be argued that moving towards addressing the concerns requires accounting for sociotechnical agency. Section 2.2 described co-production and later ANT as examples of approaches that allow accounting for sociotechnical agency. Theories of 'co-production' are used here in a way that does not imply fixity, acknowledging that this co-production is unfinished, and subject to different enactments that can shape it differently. This enables understanding the Web and society as mutually constitutive, and co-evolving. These aspects of ANT and co-production are then combined with theoretical perspectives that argue for reflexivity whilst considering technologies a part of the answer, rejecting anti-tech arguments. In this sense, these theoretical perspectives enable asking critical questions whilst remaining embedded within an optimistic framing. This is based on the argument that the unfixed nature of technologies provides an opportunity for re-appropriating them to mobilise sociotechnical agency that can bring about positive change drawing on various works of Haraway. This includes applying her notion of situatedness for becoming attentive to the concerns surrounding technological innovation and development, whilst her 'staying with the trouble,' although belongs to a different context, is taken as inspiration to go beyond the critique, and open up a space for working across boundaries, making alliances, and cultivating capacities for mobilising new forms of agency for bringing positive change.

This enables acknowledging the benefits of OBTA in generating revenue for the production and dissemination of online content and web services such as search, whilst not dismissing the investigation on how technical qualities can come with affordances that can impact social capabilities. This includes if and how the technical affordances of OBTA enable mirroring, or re-enforcing existing social issues such as inequalities and discrimination, or facilitate emergent uses of OBTA in ways that are unexpected, and socially un-desirable, such as the spread of problematic information online.

Today OBTA have become an integral part of the Web. Their business models sustain the production and dissemination of online content and their technologies are embedded in different forms in the Web. Addressing the concerns surrounding them, therefore, is important. This thesis argues that enabling research on OBTA is necessary for investigating if and how the affordances of OBTA and the social capabilities that they enable,

may facilitate or re-enforce existing social issues, or raise to new contingent conditions where these affordances are re-appropriated by social or cultural forces in ways that raise concerns. However, OBTA are currently opaque and researching their operations is challenging.

It is then argued that enhancing transparency that can enable research on OBTA and where and when they can lead to undesirable social effects, requires exploring if and how new forms of agency can be mobilised by engaging across disciplines and actor groups. This thesis experiments with one such approach. to experiment with speculative design, to conceptualise a model for communicating operational details in OBTA, and engage with actor groups and disciplines to explore if and how capacities for transparency can be mobilised (even-though partially), and explore some of the sociotechnical imaginaries at work that can shape our expectations about the future of OBTA and to some extent, the Web.

Chapter 3

Online Behavioural Tracking and Advertising

As the Web grew and more people interacted with online resources, OBTA technologies and practices were used for documenting, collecting, and monetising these interactions. On the one hand, OBTA enabled a wide range of new online services and generated revenue for online publishers. On the other hand, there are growing concerns about undesirable social effects surrounding OBTA, whilst the dependency of the Web on OBTA has raised critical questions about the direction of its evolution.[1]

This chapter starts by introducing OBTA technologies and practices and historicising them in the wider social and economic milieu: The changing context of OBTA and the Web may be understood within the broader context of the historical trajectory of the global political economy. In addition to these politico-economic relations, sociotechnical, and cultural relations have also been co-producing OBTA and the market for their technologies and practices. Building on this, the chapter argues that OBTA technologies and practices are inseparable from their wider context and investigating concerns surrounding them requires beyond adopting a purely technical, social, or economic lens. The chapter ends by emphasising that a sociotechnical exploration of OBTA is crucial for thinking about the future of the Web, asking *how can a sociotechnical understanding of OBTA be developed?*

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[1]For details see Berner-Lee's quotes in (Berners-Lee, 1993, pp.21) and Solon (2017) detailed in Chapter 1.

3.1 Definitions

Online Behavioural Tracking and Advertising (OBTA) constitute key business models on the Web. Therefore, exploring them is essential for thinking about the future of the Web. This section takes the first step in this direction by describing what is meant when referred to OBTA technologies, mechanisms and practices in this thesis. To begin, it is essential to differentiate 'tracking' from 'targeting.' As Bilenko et al. (2011, pp.3) clarify:

> 'the former refers to the process of data collection and processing, while the latter focuses on the use of processed data for personalization in the context of a specific task, such as advertising.'

Building upon this, for the purpose of this thesis, OBTA refers to any combination of tracking and/or targeted advertising. The similarity of targeted advertising with other technologies and practices such as personalisation and recommender systems, and the occasional lack of clarity over what constitutes targeted ads, gives OBTA a dynamic scope. The remainder of this section aims to justify this statement by drawing on academic and grey literature.

3.1.1 Tracking

'Tracking' has been defined differently amongst different stakeholders.[2] This thesis builds upon the Center For Democracy and Technology (2011, pp.3)'s provisional definition of tracking that states:

> 'Tracking is the collection and correlation of data about the web-based activities of a particular user, computer, or device across non-commonly branded websites, for any purpose other than specifically excepted third-party ad reporting practices, narrowly scoped fraud prevention, or compliance with law enforcement requests.'

Building on the above definition, in this thesis, Online Behavioural Tracking (OBT) refers to any combination of technologies and practices that collect data from user agents'[3] interaction with online content and devices,[4] and attribute a unique identifier to these data, that are then processed, for example, to infer psychographics and/or demographics based on the perceived meanings of the interactions, and classify the user(s) associated

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[2] For example, see W3C Tracking Protection Group (2011).

[3] User Agent (UA) is defined as 'The client which initiates a request. These are often browsers, editors, spiders (web-traversing robots), or other end user tools' (Fielding et al., 1999).

[4] For example, metadata about session level activities, swipes, clicks, properties of devices, and browsers location, etc.

with them into segments and/or individualised profiles. These data can then get combined with other data sources,[5] and exchanged with other entities to be used for a variety of purposes including, but not limited to, targeted advertising.

Tracking might be employed by 'first party' websites (the website that the Web user directly visits on the Web),[6] or 'third-parties' (entities other than one that the Web user is visiting) (Roesner et al., 2012). The resulted collected and processed data might be used for a wide range of purposes in aggregate, or non-aggregate forms. Aggregate forms of online behavioural data can provide insights about the interactions of populations with online resources. This is valuable for social science research in various sectors, such as academic, policy, or commercial research.[7] For example, in commercial research, aggregate behavioural data might be collected and processed by websites for analytics and measurement of users' interactions with Web pages to evaluate and optimise the performance of a Web page, or its features, such as a placed advertisement (Tene and Polonetsky, 2012).[8] Non-aggregate forms might be used for classifying and sorting profiles inferred from the online behavioural data (Network Advertising Initiative, 2011). Behavioural data can be combined with various other types of data (e.g. geodeomgraphics) for market research, personalisation, targeted advertising, as well as differentiating online services, products, and prices (Christl and Spiekermann, 2016).

3.1.2 Targeted Advertising

Advertising practices are sometimes classified based on their targeting methods.[9] The aforementioned definition of targeting by Bilenko et al. (2011) conceptualises targeting as the usage of processed data for tailoring and personalising. The heterogeneity and range of the types of data, methods, tools, strategies, practices, and technologies used for processing data, in combination with those for tailoring and personalisation, mean that targeted advertising can take various forms. This section introduces some of these key forms.

The sources of data used for targeted advertising are diverse, and include, but are not limited to, online behavioural data. The specific mechanisms, technologies, and practices that use behavioural tracking to tailor ads based on what is perceived relevant, or of

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[5]Other sources here include offline data, or data that is not necessarily behavioural. The definition of behavioural tracking in this thesis is inclusive of, and not restricted to any of these data sources, and the mechanisms and practices used for obtaining, or processing them. Examples of external sources are retailers' Customer Relationship Management (CRM) and royalty data, location of device through connection to public wi-fis, etc. For a full account of the type of data that might be used for online advertising, marketing and profiling see Christl and Spiekermann (2016).

[6]For an example, see Butler et al. (2006).

[7]For an example of an approach for using aggregate behavioural data by a monetising platform see Ramer et al. (2009).

[8]With the growth of IoT devices, analytics technologies and practices are re-purposed for measuring interaction with IoT devices (Mikusz et al., 2015).

[9]For example, see Mayer (2011a).

interest to the users are often referred to as Online Behavioural Advertising (OBA) (Toubiana et al., 2010). OBA is considered the primary motivation behind tracking on the Web (Eubank et al., 2014).

OBA can be based on deterministic, or probabilistic tracking. For example, a Web user's interests and preferences might have been self-reported when taken part in commercial surveys, or when registering on a website,[10], or they might have been inferred from their interactions with online resources.[11] Similarly, matching ads to users might be based on what is inferred to be relevant to them. For example, inferences might be made based on historical data that correlates certain geodemographic information with certain purchasing behaviour. Moreover, an online retailer might target an individual with an ad based on their prior engagement with a product, company, or website. Where a Web user has previously searched for, clicked on an ad, or visited a web page about a specific product, or company and this data has been used for targeting them with a behavioural ad about the same product, or company, the technologies and practices used are often referred to as 'retargeting.'

Targeting can vary in scope, both in terms of the company engaging in them, and in terms of the user(s) subjected to them. For example, with regards to retargeting, a Web user's data collected by a specific company might inform targeting practices within, or beyond the same company, or website (Lambrecht and Tucker, 2013). The former is sometimes referred to as 'generic retargeting' and the latter as 'dynamic retargeting' (Lambrecht and Tucker, 2013). At the same time, the behavioural data collected from the Web user and the inferences based on them could be used for marketing the same product to a wider group of people that is imagined to have similar demographic and/or psychological traits.

In addition to tracking and targeting, advertising practices also vary based on the technologies and practices used for trading ad-space, or serving, and displaying ads that will be detailed in the following sections.

3.1.3   OBTA, Contingency, & Interpretive Flexibility

For simplification, in this thesis OBTA refers to any combination of Online Behavioural Tracking (OBT), and/or targeted advertising technologies and practices.[12] This section aims to justify this flexible scoping by focusing on two main points: 1. The increasing

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[10]For example, the user might have disclosed their preferences and interests at the sign-up stage to the first-party website, and receive targeted ads that are considered relevant to these interests (Bilton, 2015).

[11]This is often through computational processes. For example, identifying users might be via inference facilitated by machine learning and statistical methods based on their behavioural patterns, or device/browser characteristics as there is no access to more deterministic data such as first-party data (Bilton, 2015).

[12]Based on this definition, in this thesis the term 'OBTA industry' is used to refer to wide range of actors on the spectrum from supply to demand for collecting, processing, sharing and usage of online

entanglement of similar technologies and practices on the Web in sectors beyond targeted advertising makes the definition of ads evolving and not fixed. 2. There is interpretive flexibility about what constitutes an ad on the Web. The following paragraphs expand these points.

From a technical perspective, behavioural advertising (OBA) is considered an instance of personalisation (Eubank et al., 2014). More broadly, technologies and practices like targeted advertising may also be used to recommend products and services that are differentiated in their offerings, prices, or quality based on their targeting strategy. This means that different forms of the same technologies and practices are entangled in a wide range of online platforms, websites, and businesses. This accounts for flexibility of scope in defining OBTA in terms of the processes of targeting and the logic underlying them. As a result, it is increasingly challenging to demarcate ads from other types of targeted content subject to personalisation, differential pricing, or recommender systems. This makes the scope of the definition of an ad to be evolving, and not fixed. With the increasing entanglement of OBTA in its different forms in and on the Web, it is increasingly important to consider this flexibility of scope when exploring the relationship between OBTA and the evolution of the Web, their surrounding concerns, and in considering approaches for addressing them.

Additionally, the scope of what constitutes an 'ad' has changed through the past decade and continues to change. From the perspective of the advertising industry, ads can take diverse forms such as classified ads, display ads, social ads,[13] search ads, etc. However, whilst some ads are often recognised by the Web users, others are not always interpreted the same way. This is sometimes because some types of ads do not signal advertising material as clearly as others or might even be disguised in the form of other types of content. For example, advertorials, or 'native advertising' are often 'disguised as editorial content' (Hoofnagle and Meleshinsky, 2015). Despite the 'sponsored content' disclosure, some Web users assume that advertorials are written by a reporter, or an editor (Hoofnagle and Meleshinsky, 2015).

Consequently, whilst the different forms of ads and the criteria that demarcates them from each other and other types of online content might be clear from the point of view of the advertising industry, this is not always as clear from the perspective of the Web users. As a result, different forms of ads might not always be interpreted, recognised, or understood as advertised content. This is seen not only in the case advertorials, but also in the case of search advertising. For example, Ofcom studies on adults' media use and attitude in the UK in 2016 and 2017 suggested that approx. half of the search engine users within their sample could not correctly identify ads, or sponsored links in a results page of a search engine (Ofcom, 2016). A similar study by Ofcom in 2018, suggests that

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and offline data and metadata. This includes, but is not limited to, data aggregators, data brokers, publishing industry, online intermediaries, marketing and advertising industry.

[13]'Social ads' incorporate and display Web users' interactions and their 'persona (picture and/or name) within the ad content' (IAB, 2009, pp.4).

the majority of users of price comparison websites from their sample remain 'unaware that the deals listed first might be adverts' (Ofcom, 2018, pp.14). This interpretive flexibility makes the scope of the definition of ads in flux from the perspective of various stakeholders, that requires to be taken account when scoping and defining OBTA.

3.2   Common technologies and practices

The previous section defined what is meant by tracking, targeted advertising and OBTA in this thesis. It was noted that OBTA can vary based on the technologies and practices used for tracking and targeting users, trading ad-space, or serving and displaying ads. This section aims to expand on this by introducing some of the common types of OBTA technologies and practices, starting with tracking in the following paragraphs.

3.2.1   Tracking

Studies show that users are increasingly tracked and profiled online (Castelluccia and Narayanan, 2012; Krishnamurthy and Wills, 2009; Chaabane et al., 2012a,b). The usage of cookies for tracking has been growing in the past decade (Altaweel et al., 2015). As of 2012, HTTP cookies were suggested to be the most prevalent tracking mechanism used on the Web (Roesner et al., 2012). Many of these cookies are found to be set by third-party hosts. For example, an experiment by Ayenson et al. (2011) consisting of a simulated user session on the top 100 websites and 10 random clicks on each website found that most cookies were set by third-party hosts. Similarly, In 2015, Altaweel et al. (2015) found the majority of the cookies set upon visiting top 100 websites to be third-party cookies.

Tracking can be classified based on the party involved, or the scope of tracking. For example, by observing tracking behaviour on the Web in a bottom up approach, Roesner et al. (2012) classified tracking behaviour into analytics (third-party/within the website), vanilla (third-party/cross-domains), forced (cross- domain/first-party), referred (using leaked cookie id/cross-domains), and personal (cross-domain) based on party and/or scope of tracking.[14] Moreover, the scope of tracking can be limited to one device, or be across various devices. Cross-device tracking refers to technologies and practices that aim to facilitate tracking across multiple devices (Ramirez et al., 2017; Schiff, 2015). Similar to other types of tracking, cross-device tracking can be deterministic (first-party login data), deterministic (shared credentials), or probabilistic (Brookman et al., 2017). Deterministic cross-device tracking often involves correlating 'unique devices to a common persistent identifier–such as a name or email address' (Brookman et al., 2017, pp.136). Logged-in cross context tracking is enabled when a user logs in to their personal accounts

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[14]For the details of these classifications see Roesner et al. (2012).

from various devices. It is suggested that market activity on deterministic cross-device tracking is mostly dominated by a few key OBTA actors (Schiff, 2015). Shared credential cross-device tracking is enabled when third-party companies that do not have direct log-in relationship with the user, have contractual relationship with other companies that do (Brookman et al., 2017, pp.136). Additionally, there are various practices that enable sharing tracking information between entities that mean that the scope of tracking might not be fixed. For example, Acar et al. (2014) describe cookie-syncing as of these practices that enables sharing identifiers despite browsers security restrictions. The Same-Origin Policy is a security restriction in JavaScript that prohibits scripts from reading properties of online resources that are not loaded from the same host, through the same port, and by the same protocols (Flanagan, 1998, pp.402). Acar et al. (2014) note that:

> '*Cookie syncing*, a workaround to the Same-Origin Policy, allows different trackers to share user identifiers with each other. Besides being hard to detect, cookie syncing enables back-end server-to-server data merges hidden from public view' (Acar et al., 2014, pp.674).

In addition to party and scope, online tracking can also be classified based on whether it relies on cookies, or employs non-cookie based (i.e. stateless) technologies and practices. The following section details this by introducing cookie, a web technology that was re-appropriated to become a key element of OBTA.

3.2.1.1 Cookies

Cookies can be used for behavioural tracking as well as providing basic functionality for a website. Even though cookies have been commonly used in OBTA, they were not originally designed for this. Over time, cookies evolved to be used in ways beyond what was intended at the time of their design. This section introduces cookies and describes these sociotechnical processes of change in their evolution.

Cookie refers to 'the state information that passes between an origin server and user agent, and that gets stored by the user agent' (Kristol and Montulli, 1997, pp.3).[15] Cookies were originally designed in 1993 by Lou Montuli (Kristol, 2001) from Netscape Communications and were integrated into the Netscape browser version 1.1. with an aim to add a 'persistent, client-side state' to an otherwise stateless HTTP protocol to enable writing new Web applications (Netscape, 1996). A stateless HTTP meant that each request sent by the client (e.g. individual's browser) would be treated by the server as it was a new request and regardless of any previous interactions. Cookies enabled setting an identifier for the client in their HTTP response that could be sent back to the server in the following requests and make the client traceable. This identifier would be

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[15]See also Kristol and Montulli (2000).

stored on the client, allowing servers to remember the sender of the request and send responses based on previous HTTP requests sent from the clients.

The original HTTP in 1992 provided similar capabilities for transmitting state information (Moore and Freed, 2000, pp.2). For example, session identifiers could be passed through URLs, or through HTML forms as a means to exchange state information (Moore and Freed, 2000, pp.2). However, such methods are not sufficiently secure. In this sense, cookies enhanced HTTP's capabilities in various areas such as security by reducing the possibility of leaking state information when URLs are exchanged between users. The ability to save state between HTTP transactions was largely beneficial for the development of various new applications (Moore and Freed, 2000, pp.1). For example, cookies enabled shopping applications to retain shopping basket information, or retain user preferences (Netscape, 1996). The possibilities that cookies enabled, led to the standardization of cookies by the standard setting body, Internet Engineering Task Force (IETF).

Cookies vary based on their lifespan, the party that specifies them, and whether their scope is limited to one domain (e.g. for first-party analytics), or if they can be retained and accessed across different domains (e.g. in cross-domain tracking) (Roesner, 2014). The following paragraphs detail what is meant by party and lifespan in this context.

- The domain that the user directly visits is often considered a first-party domain. This makes any content hosted by this domain first-party content, and cookies set by them first-party cookies. However, when a user visits a webpage, the page is often designed in such a way that the browser would need to request and draw together resources from servers other than the domain that the Web user is directly visiting. Some of these resources might be for the purpose of displaying content, or ads, or they might be purely for the purpose of tracking (Krishnamurthy and Wills, 2009). The domains other than the first-party domain that the browser sends requests to, are often considered third-party domains (Krishnamurthy and Wills, 2009). Third-party domains can not only set third-party cookies, but also could employ several technologies and practices to set or employ first-party cookies for storing state information. More broadly, third-party domains might 'only set third-party cookies,' 'use JavaScript with state saved in first-party cookies,' or 'both third-party cookies and JavaScript to set first-party cookies,' amongst other approaches (Krishnamurthy and Wills, 2009, pp.544).

- Some cookies only remain valid for the duration of a browsing session, whilst others stay in the browser until they get expired, or the user deletes them. Therefore, one way for identifying persistent cookies is to check if their values remain unchanged during different visits to the website.

Differences in how cookies are scoped -both in the terms of the party accessing and retaining them, and their lifespan,- makes the use of cookies versatile. After the design

of cookies it was revealed that cookies could be used for a wide range of purposes some of which were different from their intended use at the time of their original design. They might be solely functional for example, to be used for simplifying the interaction between the clients and servers and managing sessions, or analytical to be used for understanding the interactions of Web users with a web page in aggregate forms. Meanwhile, they could also be used in ways that were not initially imagined. For example, the combined usage of referer header and third-party cookies raised concerns for privacy advocates (Krishnamurthy et al., 1999). Referer is an 'optional header field allows the client to specify, for the server's benefit, the address (URI) of the document (or element within the document) from which the URI in the request was obtained.' (W3C, 1992), and 'allows a server to generate lists of back-links to documents, for interest, logging, etc. It allows bad links to be traced for maintenance' (W3C, 1992). The aforementioned privacy concerns were directed towards the fact that the combined usage of third-party cookies and referer could enable sites to start gather a profile of users' visits (Krishnamurthy et al., 1999).

In response to the concerns, RFC 2109 introduced some changes on the recommended usage of cookies. According to Kristol and Montulli (1997, pp.17), it was agreed in the working group that the draft of the specification would be amended to include restricted default acceptance of third-party cookies by browsers (sections 4.3.5 and 8.3 of RFC 2109). As a result of this, the specification required user agents to reject cookies that were initiated by unverifiable transactions (Krishnamurthy et al., 1999, pp.1748). However, this restriction and RFC2019 became controversial (Kristol, 2001). According to Kristol (2001), the key backlash was from the Web advertising networks whose business models relied on the use of third-party cookies for targeted advertising and saw the restriction as a threat to their businesses. He suggests that consequently, this resulted in a 'heated protest' and the publication of a series of articles on popular and trade media, whilst the IETF working group took the position that this restriction 'would affect the advertisers' business models that relied on tracking users, not the advertising business itself' (Kristol, 2001, pp.12).

Despite this, and other attempted interventions, in the coming years the use of cookies evolved in such way that sometimes provoked privacy concerns for privacy advocates. In the years that followed, the use of cookies evolved to go beyond their original design intentions, and cookies became common component of OBTA technologies and practices.

Moreover, cookies were not the only web technologies that were re-appropriated for OBTA. This re-appropriation can also be seen in other technologies such as ETag and HTML5 local storage. ETag is a header field that enables differentiating various representations of the same online resource (Fielding and Reschke, 2014). HTML5 local storage enables storing application data that are necessary for the functionality of applications in a similar way to cookies (W3C, 2013). Using Web storage can have security advantageous overusing cookies, as cookies are transmitted with every request. ETag

and HTML5 storage have been re-appropriated to be used for tracking in a similar way to cookies.

Ayenson et al. (2011, pp.1) found that ETags are sometimes used in the 'cache cookie method' whereby, tracking can continue even when all cookies are blocked, and in the 'private browsing mode.' Moreover, the combined usage of cookies with other technologies such as ETags, and techniques such as 'respawning cookies,' enable more persistent tracking (Ayenson et al., 2011). Re-spawning enables linking a user's browsing logs before cookie clearing to browsing logs after cookie clearing (Soltani et al., 2010). ETags, HTML5, Flash LSO (another form of client storage) are sometimes used for storing a copy of the cookie-Id: the domain that specifies the Set-Cookie header stores a copy of the unique identifier of that header in these storage mechanisms prior to deletion of the cookie to later specify a new Set-Cookie header with the same unique identifier. This means that if the cookies are deleted, the copy of the cookie-id kept on other storage is used to continue tracking.

Similarly, different types of storage mechanism used in combination with the cookies, 'Flash cookies,' 'evercookies,' and 'zombiecookies' enable more persistent forms of tracking. For example, '*Evercookies* actively circumvent users' deliberate attempts to start with a fresh profile by abusing different browser storage mechanisms to restore removed cookies' (Acar et al., 2014, pp.674).

3.2.1.2 Stateless Tracking

OBTA technologies and practices have been introduced and discussed in popular media for nearly a decade.[16] As the concerns surrounding OBTA were more commonly discussed in public forums (Rodríguez and Velasco, 2010), and concerns became more widespread (Madden et al., 2014), the Web users became more aware of their digital footprints (Madden and Smith, 2010), and engaged in clearing cookies, or blocking ads (PageFair, 2013; PageFair, 2016). Consequently, the OBTA firms have been looking for ways to reduce their reliance on cookie-based tracking, seeking alternative technologies and practices (IAB, 2014). This section describes some of these technologies and practices.

In the past decade various inference-based and fingerprinting techniques have been found to enable tracking without relying on cookies (Nikiforakis et al., 2013; Acar et al., 2014) . Fingerprinting techniques have been identified that employ different technologies and strategies. An example of these is 'canvas fingerprinting.' Canvas is a component of the HTML5 specification that enables creating and rendering dynamic images and graphs (W3C, 2014). As Mowery and Shacham (2012) figured, examining the pixels generated after text is rendered to a canvas element can enable fingerprinting the browsers on the

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[16]For example, see Angwin (2010).

Web. This is because configurations such as the operating system, graphic card, etc. can render pixels of the image with slight differences, in such way that can be almost unique. In 2014, Acar et al. (2014) found empirical evidence of similar methods in use by websites for uniquely identifying browsers.

Additionally, Diaz et al. (2015) found that HTML5 Battery Status API can also be used for browser fingerprinting as different states and lifespans of the battery status can be used as a near unique identifier, suggesting that this can be used for tracking (Diaz et al., 2015). Moreover, in 2016, Englehardt and Narayanan (2016) found WebRTC being used for tracking IP addresses. WebRTC is a specification that enables Peer-to-peer exchanges of data between browsers and other devices (Bergkvist et al., 2018).

Englehardt and Narayanan (2016) also found other techniques being used for fingerprinting browsers. This includes the usage of audio, battery, WebRTC, HTML5 and APIs for AudioContext fingerprinting, Canvas-Font fingerprinting, WebRTC-based fingerprinting. Although, they observed that more generally, the use of such methods appears to have shifted away from OBTA and towards fraud detection (Englehardt and Narayanan, 2016, pp.1398).

Other non-cookie based tracking technologies include Deep Packet Inspection (DPI), that enables ISPs to monitor web users data across the Web and use these data for marketing (Toubiana et al., 2010); (FTC, 2012, pp.40).

3.2.2   Targeted advertising

In addition to behavioural data, advertising could be targeted based on a variety of data sources such as the content of the web page that they are displayed on (i.e. contextual targeting) (Google, c) , demographic data (i.e. demographic targeting) (Google, a), location, or IP (i.e. location targeting) (Google, f), device specification (i.e. device targeting) (Google, b), day time (daypart targeting) (Srimani et al., 2011, pp.58), or search queries (search targeting) (Srimani et al., 2011, pp.23), and more. The variety of targeting methods leads to various categories of advertising practices including contextual advertising, demographic advertising, behavioural advertising, search advertising, and so on. Moreover, in practice, many advertising practices employ a combination of targeting mechanisms. A study by Google (2012) reported that more than 50 percent of online advertisers use a variety of ad targeting methods such as re-marketing (retargeting), behavioural targeting, demographic targeting and contextual targeting to target consumers with advertisements.

Advertising practices can also be classified based on the processes used for trading data, ad-space, and ads, as well as serving ads. These processes vary based on data, strategy, method, practice, and technology (McStay, 2016). For example, trading ad-space might be automated, real time, or involve more traditional forms of marketing

strategies whereby publishers and advertisers agree upon the terms of trade without involving technological intermediaries (McStay, 2016). As a result, in addition to targeting methods, advertising practices might also be categorised based on the combination of the types of data, technologies, and strategies used for the processes involved in selecting, personalising, trading, serving, and displaying ads, as well as the devices that ads are specified for. For example, sometimes advertising practices are grouped into main categories of search, display, mobile, and classified ads. The following categorisation introduces these categories as described by McStay (2016, pp.32-54):

- *Search advertising* has been a significant part of advertising for many years.[17] Google is by far the most dominant search engine in the UK. Google's Adwords places ads that can be matched to search queries above the search results, and Google's Adsense auctions a publisher's 'ad space' to advertisers with relevant behavioural ads.

- *Display advertising* such as banner ads arrived on pre-Web Internet pages, enabling advertisers to place an ad on a page. The more traditional forms of banner ads found on the print media were often pre-determined based on the perceived characteristics of the 'audience' of the content. The more modern varieties on the Web, might employ data from users' interactions with a website, or retailer, to inform their personalisation and targeting strategies. Display ads also vary depending on the processes involve in trading ad-space, or serving ads:

  - The advertisers might directly purchase ad space from a publisher.
  - Ads might be bought from advertising networks, intermediaries with established trade relationships with various publishers that expose advertisers to a large inventory.
  - Advertisers and publishers might interact with an intermediary like a stock exchange (known as an ad exchange) that auctions impressions to the highest bidder and mediates trade information between the publishers and advertisers. Ad exchanges can vary based on the technologies and methods that they use to hold the auctions, such as real-time bidding (RTB) and programmatic.
  - Real Time Bidding (RTB) is a specific method for purchasing ad-spaces. Using RTB, ad exchanges can auction an ad-space in real-time, enabling the negotiation and deal between an advertiser and a publisher before the Web page is loaded for the Web user.
  - Programmatic is a specific method for serving ads that provides automated procedures to inform advertisers about the inventory space, allowing for optimising the ad to an ad-space. In comparison with the more traditional

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[17] As of 2018, search advertising was reported to represent 46% of total Internet Advertising revenue (PwC and IAB, 2018).

segment-based market research that were based on common socioeconomic and sociodemographic information, programmatic practices aim to enable market research based on very many variables collected from various data sources and processing these variables via machine learning algorithms. Programmatic practices often employ RTB but might also center around buying ads with a predetermined price without the involvement of the auctioning process. The promise of programmatic is to optimise the matching of the triple of the audience, ad space, and the ad through automated procedures, as well as mediating trade information between the supply and the demand side of the ad market.

- *Mobile advertising* has been growing in its share of digital advertising revenue and is expected to continue to grow in the coming years. Mobile advertising can be in the form of display, search and other types of advertising, and it might be web based, or be native to apps.

- *Classified advertising* is like traditional classified ads in local newspapers. Online classified ads are more common in the car, property, and job ad sectors.

3.3 The historical context of OBTA

OBTA technologies and practices, their emergence, and evolution can be understood within the historical trajectory of the global political economy, and in the context of the business, cultural and sociotechnical changes that arrived with the emergence of Web 2.0.[18] The wider politico-economic relations, the changes in the business strategies of publishing industry, online service providers, and advertising industry, as well as changes in consumer culture all contributed to the arrival of OBTA and its successful adoption on the Web, the co-production of new markets, and their co-evolution with Web.

This section starts by introducing this historical context through an integrated lens that relies on the theoretical positioning of this thesis described in Chapter 2. The following sections draw on a range of academic and grey literature with an aim to exemplify how OBTA markets are co-produced by a myriad of sociotechnical, politico-economic and cultural relations. This enables positioning the critique and concerns surrounding OBTA in this wider picture, that is essential for thinking about approaches towards making the necessary critical interventions for addressing them.

It is argued that changes in consumer culture, technological innovations, and business strategies in online service providers, as well as advertising, and publishing industries,

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[18]The term Web 2.0. refers to perceived changes in Web technologies as well as the focus of investment, design, and development (O'Reilly, 2005a,b). Examples include a shift of focus from websites, page views, publishing, content management systems, and taxonomies at the time of Web 1.0, to blogging, cost per click, participation, wikis, folksonomies, user generated content (O'Reilly, 2005b), and back–end development in Web 2.0. (O'Reilly, 2005b).

and the emergence of new markets and industries, have all mutually co-produced each other and co-evolved together within the context of the political economy in ways that cannot be separated from each other.

3.3.1   Mutually constitutive heterogeneous relations

The global political economy is a contributor in the emergence of OBTA, its adoption, and evolution towards key business models underlying the Web. An example of this can be seen in the case of hypertextual search engines that have been critical actors in the co-evolution of the Web. In the previous section, search advertising was introduced as a key type of advertising on the Web, and as McStay (2016, pp.27) notes, search advertising has for many years been a dominant form of advertising. Today, Google is the most popular search engine in many countries (McStay, 2016).[19] However, rather ironically, the creators of Google were deeply reluctant about relying on advertising as their business model in the early years (McStay, 2016, pp.27).

In 1998, Brin and Page (1998) published a paper that presented a prototype of Google. Noble (2018, pp.41) points to Brin and Page's work in appendix A, where they draw on Bagdikian (1983) to discuss the quality trade-offs that come with a commercially driven search engine, highlighting the inherent bias of an ad-funded search engine towards the commercial interest of advertisers and away from public needs (Brin and Page, 1998, pp.18). Wu (2017, pp.258) notes that in the late 1990s Google had gained popularity as a search engine, yet being more like an 'academic project' was in urgent need for a business model to sustain its services. Wu (2017, pp.258) describes a moment when Google 'being an unusually deliberative company, tried to think through the consequences of each choice.' Wu (2017) also makes a critical observation that presenting Google as a 'truly public project, like email, or the Internet itself' was not seriously considered at this time (Wu, 2017, pp.258 footnote). In hindsight and, from a political economy lens, it can be argued that the political economy of the time did not provide an incentive structure that would encourage such considerations.

This reluctance can also be seen more specifically about OBTA. Barocas and Nissenbaum (2009, pp.1) observe that until 2009 Google remained reluctant to adopt Online Behavioural Advertising (OBA), suggesting that this was due to exposure to public scrutiny and concerns over entering a contested field. Barocas and Nissenbaum (2009, pp.1) then observed that when Google finally adopted OBA in 2009 their concerns about trust turned out to be warranted, as after this they were more publicly scrutinised for this than their competitors despite adopting strategies for mitigating privacy concerns (Barocas and Nissenbaum, 2009, pp.1).

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[19] McStay (2016) notes that this is not the case in China, Russia, and South Korea for example.

Exploring OBTA requires paying attention to not only structural relations of the political economy, and cultural and social norms, but also, sociotechnical relations that co-produce web technologies. For example, Noble (2018, pp.40-42) explores the historical development of Google Search that builds upon the logic of academic citation analysis. She posits that Brin and Page used the model of citation analysis for determining the ranking of Web pages based on the frequency they are back-linked or hyperlinked. However, whilst academic citation analysis is only applicable to articles that have passed various 'stages of vetting and credibility testing' (i.e. the peer review process) before they could be published and cited, on the Web, credibility checking is not considered a prerequisite for ranking hyperlinks (Noble, 2018, pp.40-42).

This can be positioned within a broader mutual relationship between the cultural forces, sociotechnical relations, and the business strategies in other sections of OBTA ecosystem. For example, the advertising industry has been affected by cost-cutting strategies, and online targeted advertising promised being effective in cutting costs and wastage in advertising through only targeting ads to those that would be interested to them (Lambrecht and Tucker, 2013).[20] Lambrecht and Tucker (2013) draw on others to suggest that this appealed to many advertising companies who increasingly adopted personalised models.[21]

Additionally, measuring the effectiveness of the ads faces sociotechnical challenges. A study by Google (2014) on display advertising platforms suggested that 56% of mobile and desktop browser ads are not viewed by their target audience.[22] 'Clicktrhough' (Haile, 2014), a measure of ad performance, is suggested by some to have flaws that have contributed to undesirable outcomes such as linkbait and spam (Haile, 2014). There are on-going discussions about what counts as a more accurate metric for measuring the performance of ads on the Web. For example, Chartbeat, a data analytics firm that widely trades across the online publishing industry suggest one of the best indicators for measuring the success of a web page is the time spent on it by its visitor. A study by Chartbeat on 2 billion page visits on the Web found that 55% of visitors of an online news article spent less than 15 seconds on that article (Haile, 2014). Tony Haile, the CEO of Chartbeat, notes that their study found no correlation between how much of the article is read, and how much its content is shared by the average user on social media (Haile, 2014). There are questions about how ad performance is operationalised and measured through metrics (e.g. click, like) across the advertising industry (Wall, 2018), and what can be translated as 'conversion' (Wall, 2018).

Meanwhile, it can be argued that the sociotechnical relations of Web 2.0 have contributed to the changes in the business strategies of the advertising industry. For example, it is

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[20]An example of such promises is mentioned by Lambrecht and Tucker (2013) citing a report by (Criteo, 2010).

[21]For details see Lambrecht and Tucker (2013).

[22]Viewing in this report is operationalised by measuring if 50% of an ad's pixels are on screen for one second.

suggested that the scale of user generated content enabled by Web 2.0, motivated the advertising industry to expand their old models that broadcasted ads to broad groups (Vukanovic, 2009) as they could no longer be applicable (Van Dijck, 2013). At the same time, cultural forces contribute to the changes in the business models of the advertising industry. It is suggested that an increasing decline of consumers tolerance for commercial advertising activities abstained many online platforms from using the usual 'pop-up ads' in the early years due to anxieties of discontenting users (Van Dijck, 2013, pp.38-40).

Similarly, it can be argued that the wider politico-economic relations have contributed to changes in the publishing industry. boyd (2018a) draws attention to the significance of the gradual financialization of media, and the decline of local newspapers in the context of the US media over a number of years. According to Marwick and Lewis (2017, pp.42-43), since 1990 the publishing industry has gone through changes that has affected the way that they operate, encouraging them to look for, and adopt cost-cutting strategies. For example, it is possible that the cost-cutting strategies of the publishing industry, and the focus of their business models on attention as a commodity in the 'attention economy' amongst various other sociotechnical relations contributes to encouraging some publishers to value viral content that can garner higher clickthrough and page views (Marwick and Lewis, 2017).

Additionally, it could be argued that changes in the publishing industry may have ties with cultural relations: Online publishing often relies on advertising revenue or subscription models, and the online consumer culture is often more aligned with the former, so that the content is delivered 'free' to the consumers.[23]

It is suggested that consumer expectation for 'free' online content and services played a part in the growth and adoption of the 'free' model where consumers are not charged for online content and services, and revenue is generated from advertising instead (Van Dijck, 2013, pp.38-40). Anderson (2009) editor-in-chief of Wired US, in his 2009 book advocates the promises and advantages of the 'free' model as a means to form long term and viable business models through sponsoring by advertising, premium models, and other means (Van Dijck, 2013). Others criticised this from a sociological perspective for over-simplifying 'free labour' (Doctorow, 2009), and neglecting the existing structural inequalities that could mean that the benefits would not be equally distributed (Gladwell, 2009). This has led some to argue that an alternative approach can be to replace the 'free' model with a subscription model for certain websites, in a similar way to the approach successfully taken by 'freemium' sites such as Spotify (Edwards, 2018, pp.28). Meanwhile, sustaining content and services through advertising is not new, or specific to

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[23]The advertising industry often suggests that in 'the online world most users experience is predominantly free' (GfK, 2017, pp.4). However, this is criticised on the grounds that an emphasis on 'price' instead of 'cost' has had implications for consumer law and can even harm competition (Hoofnagle and Wittington, 2014, pp.608). For example, courts may neglect that using 'free services' often requires exchanging personal information.

the Web per se, and has been established as a revenue model in the old and traditional media.

Additionally, there are ties between the sociotechnical relations of Web 2.0 and the wider cultural relations. Beer (2009) highlights the potential ties between the wider celebrity culture, and the Web 2.0 culture. Marwick (2010, pp.427) explores this in the context of changes in the mass culture towards 'micro-celebrity,'[24] arguing that:

> 'Web 2.0 discourse as instantiated in software inculcates a neoliberal subjectivity which encourages people to see themselves as users, products, and packaged commodities.'

As a result, it can be argued that the sociotechnical relations of Web 2.0, cultural relations and the wider politico-economic relations are interlinked and have all contributed to the changes leading to today's significance of OBTA as business models for the Web. Meanwhile, Marwick (2010) also adds that the commodification of self and self-branding are not inherent properties of social media and Web 2.0 and are enabled by them that, then some people might choose (Marwick, 2010, pp.347). In this sense, the complexities of social agency reject deterministic explanations of change. Meanwhile, Marwick (2010) finds attention at the core of micro-celebrity culture, suggesting that micro-celebrity '... is a way of thinking about the self as a commodity that draws from advertising, reality television, and the cultural logic of celebrity' (Marwick, 2010, pp.232). This culture encourages using advertising and marketing technologies and practices to 'sell the self' (Marwick, 2010, pp.347), and supports the business models that depend on selling 'eyeballs' to advertisers, or data brokers (Marwick, 2010, pp.427). This shifts the attention to the data brokers, or data aggregators, that are key actors in the co-production of OBTA. The following section will briefly describe the data broker industry.

3.3.2 Data brokers

A key actor in the emergence and evolution of OBTA technologies and practices is the data broker industry. The history of this industry goes far back before the arrival of the Internet and the Web. Kitchin (2014b, pp.42) contrasts the motivation behind data infrastructures in academic research and the private sector: Whilst the former aims to create a data commons for data sharing and reuse, data brokers consolidate data from a variety of sources on private infrastructures, treating them as business assets that can be rented, licensed, or resold for profit [pp.42].

The data used by the data brokers include a wide range from sociodemographic and socioeconomic data, to behavioural data. These data sources are often consolidated with

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[24](Marwick, 2010, pp.230) defines micro-celebrity as a 'mindset and set of practices in which one's online contacts are constructed as an audience, or fan base, popularity is maintained through ongoing fan management, and self-presentation is carefully assembled to be consumed by others.'

other data sources to give a bigger picture about the individuals and groups, and they might be resold as they are, or go through further processes as part of 'value-added services' to derive meaning and predictions from these data (Kitchin, 2014b, pp.42).

The motivation for collecting and consolidating data and behavioural data by the data broker industry, has created a 'significant stream of revenue' for various online firms (Kitchin, 2014b, pp.42). The suppliers of these data include a wide range from online and offline retailers, credit card companies, store loyalty programs, Customer Relationship Management (CRM), as well as clickstream data (Kitchin, 2014b, pp.42-43). Online firms that supply behavioural data include social media companies, online media such as newspapers and magazines, amongst other businesses to either sell these data, or its derivative value added products to data brokers that are interested in trading the data, and advertising companies that are interested in using the data for targeted ads (Kitchin, 2014b, pp.43).

The demand side of the data broker industry, is not limited to advertising companies, but includes entities that evaluate customers who apply for credit, insurance, educational institutions, people-search services, and background checks (Kitchin, 2014b, pp.43-44). The data broker industry has a reputation for having a 'low-profile' and being 'secretive' (Kitchin, 2014b, pp.44). In the more recent years, following high profile scandals and various security breaches, the business practices of the data broker industry is increasingly discussed and more closely observed (Kitchin, 2014b, pp.45).

3.3.3   The co-production attention economy

As illustrated in this section, various sociotechnical, cultural, and politico-economic forces are in a mutual relationship with each other, and co-produce new markets and industries for OBTA. Data (including behavioural data) is increasingly being monetised for production and dissemination of online content and services as a wide range of businesses. It is argued that the modes of production are increasingly becoming data-driven, whereby data, as new commodities, contribute to a new political economy often referred to by terms such as 'information capitalism' (Castells, 1996), 'digital economy' (Tapscott, 1996), 'attention economy' (Goldhaber, 1997), 'knowledge capitalism' (Thrift, 2005), 'digital capitalism' (Schiller, 2000), 'platform capitalism' (Srnicek, 2017), and more. Amongst these, the 'attention economy' is particularly relevant, highlighting how value is attributed to online content that attracts public attention, and therefore, attracts advertising revenue (Wu, 2017; Marwick and Lewis, 2017).

OBTA and their underlying technological infrastructure are key drivers of the attention economy. But this doesn't mean they have caused the emergence of the new political economy: Considering technologies sole responsible for social change leads to a technologically deterministic view that oversimplifies complex sociotechnical relations. A more

nuanced view considers the attention economy co-produced by various social, political, and economic forces as well as technological innovation. Similarly, OBTA technologies and practices themselves emerged within the context of their underlying political economy and are co-produced by various sociotechnical and cultural forces. This includes technical developments that facilitate the data flows between the digital content production industry (e.g. publishing, entertainment industry, etc.), the demand of their 'eyeballs' for the advertising industry, and brokers (ad brokers, data brokers, etc.) that negotiate, reorganise, and determine the value of the data collected by data aggregators, the 'eyeballs' identified by publishing and content production industry.

Moreover, interest of the advertising industry in attention- as a commodity- goes back before the era of the Web. For example, as (Wu, 2017, pp.64) suggests in his book 'The Attention Merchants,' decades before the Web, the advertising industry had already become increasingly efficient in employing insights from other disciplines such as psychology to grasp consumers' attention. It has long been theorised that the increasing ability to access information can lead to scarcity of attention as a new valuable resource (Simon, 1971). This became increasingly materialised with the arrival of OBTA technologies and practices, and growing interests for measuring Web user's attention (Haile, 2014). In the years that followed, it became apparent that Web businesses compete for capturing attention, giving attention a new found value (Wu, 2017), that was soon normalised as a commodity (Fairchild, 2007, pp.359).

At the heart of the Web OBTA are key underlying business model for online content production. As demonstrated in this section, the emergence of OBTA as a main business model on the Web widely interlinked with wider social, technical, economic, business, political, and cultural context. The evolution of online service providers, changes in publishing and advertising industry and their financial strategies, changes in consumer culture and social norms, and their relations with the wider global political economy with its expanding markets for behavioural data, all co-produce changes leading to today's over-reliance of the Web on OBTA as a major business model. Thinking about the concerns surrounding OBTA, and the future of the Web in relation to OBTA, requires an approach that takes all of this into account.

3.4 Conclusion

OBTA collect and monetise data and behavioural data from the everyday online interactions of individuals and groups. In introducing OBTA technologies and practice, the importance of distinguishing different types of advertising and targeting was emphasised: Contextual ads that are based on the context of the website hosting the ad, share similarities with the traditional types of advertising on printed newspaper, or broadcast TV, and often do not involve behavioural tracking. Re-targeted ads can be based on

deterministic previous interactions such as clicking on an ad, or buying a product, and in many cases do not involve inferring demo/psychographic of individuals, or groups. Behavioural ads are based on previous behaviour and can be probabilistic, and based on processes that are likely to involve inferring demographic, or psychographic traits from previous behaviour, and therefore often involve both behavioural tracking and inferring what is perceived of relevance/interest. Meanwhile, all of this are referred to as 'targeted advertising' for the purpose of this thesis: Contextual ads are targeted to the content of a webpage, re-targeting ads are targeted to previous purchase/click, behavioural ads are targeted to what is perceived of interest/relevance to individuals and groups. There are also other types of targeting such as geographic, location, time, or technical specification targeting. Targeting techniques share deep similarities with personalisation, and recommender systems used for a wide range of purposes including personalising offers and discounts that are common practices in the retail sector. The technologies and mechanisms of OBTA are today embedded in the Web, either in the form of behavioural tracking and targeted advertising, or in other forms of tracking and targeted content delivery.

It was argued that the emergence and evolution of OBTA technologies and practices have been largely impacted by the political economy of the time, as well as various social and cultural forces. The private (business) and public (cultural) relations have been in a mutual relationship with the wider politico-economic and sociotechnical relations that co-produce OBTA. It was then illustrated in this chapter how inseparable politico-economic, sociotechnical and cultural forces have resulted in the entanglement of OBTA technologies and practices in the Web in different forms, and growing over-reliance on them as business models. Moreover, the data broker industry that has been operating from prior the emergence of the web, along with other public and private sociotechnical relations have contributed to shaping new market for data, metadata, and attention. The interplay of these within the evolving context of the political economy, and their co-evolution is contingent, and can be understood differently.

With the theoretical approach described in Chapter 2, this chapter set the scene for the wider context in which technologies and practices of OBTA are situated. OBTA were introduced as sociotechnical assemblages, and their common technologies and practices were outlined. It was illustrated how inseparable sociotechnical, cultural, and politico-economic relations co-produce attention economy and co-evolve together. All of this means that OBTA technologies and practices and the concerns surrounding them cannot be understood in isolated disciplinary lenses. Studying the changes leading to the prevalence of OBTA as a major business model on the Web requires an interdisciplinary approach, thinking about the future of the Web and OBTA requires a sociotechnical approach, and paying attention to the increasing entanglement of OBTA in the Web in different forms.

This raises a question ***how can a sociotechnical understanding of OBTA be developed?*** The following chapter takes the first step towards answering this question. Empirical examples about the concerns surrounding OBTA are outlined to better understand when and where concerns arise, that is crucial for developing a sociotechnical understanding of OBTA.

Chapter 4

Critical questions surrounding OBTA technologies and practices

Chapter 3 started from the premise that exploring OBTA and the concerns surrounding them is critical for thinking about the future of the Web. Key OBTA technologies and practices were introduced and it was argued that OBTA are inseparable from their wider context and concluded that understanding their technologies and practices requires a sociotechnical approach for exploring the heterogeneous actors that comprise them. The chapter ended by asking *How can a sociotechnical understanding of OBTA be developed?*

This chapter takes the first step towards answering this question. Developing a sociotechnical understanding of OBTA and the concerns surrounding it, can on the one hand benefit from, and on the other hand, contribute to, the wider domain. As a result, this chapter starts by a brief exploration of data and algorithms, key sociological debates surrounding them as well as some of the critical questions from the wider field of critical data and algorithm studies (Kitchin, 2014b; Dalton and Thatcher, 2014; Gillespie and Seaver, 2015). It then draws on academic and grey literature, to provide empirical examples of issues and concerns in areas as wide as discrimination, exclusion, privacy harms, problematic targeting of ads/content, trust, security, and more. This all aims to provide a strong grounding from which to address the questions raised in this thesis.

It is argued that more empirical research is needed for making the issues visible, and investigating when and where the use of OBTA can exacerbate existing social issues or lead to new types of undesirable social effects. However, currently OBTA technologies and practices are opaque. This means that where there are issues, they can be masked and get baked into the Web without scrutiny, and where there is no need for concern, this opacity can negatively impact public trust. The chapter concludes that

operational transparency in OBTA can be a first step towards developing a sociotechnical understanding of OBTA, asking **how can transparency in OBTA operations be enhanced?**

4.1   The wider picture

Chapter 2 provided an overview of some of the key theoretical perspectives from STS, and the wider debates for thinking about the relationship between technology, and society. It was noted that that STS has moved towards 'critical and cultural studies of science and technology' (Hess, 1997, pp.85). Nuanced critical questions surrounding data and algorithms have been increasingly asked, particularly in the emerging fields of Critical Data Studies (Kitchin, 2014b; Dalton and Thatcher, 2014; Iliadis and Russo, 2016), and Critical Algorithm Studies (Gillespie and Seaver, 2015). Themes include, but are not limited to, challenging the idea of neutrality in data and algorithms, exploring when and where Big Data technologies and practices contribute to undesirable social effects such as exclusion of social groups or re-enforcing existing inequalities, if and how the contributing heterogeneous relations can be investigated, and approaches for moving towards addressing the concerns. The following paragraphs start by introducing Big Data and algorithms and what is meant by them in this thesis, before detailing some of the critical questions surrounding them in the wider picture to contextualise the concerns and questions surrounding OBTA.

Advances in computer memory and processing power along with computational methods have enabled collecting and researching large scale datasets. In the past decade, the term Big Data has been increasingly used to refer to various types of large scale data, sometimes generated in near real time. The term has often been used in reference to Laney (2001)'s 'three Vs': Volume, Velocity, and Variety (Ward and Barker, 2013). However, Cukier and Mayer-Schoenberger (2013) point that although the scale of Big Data makes them different from other data, it would be misleading to understand the term only in terms of scale. Kitchin (2013, pp.262) highlights the additional characteristics of Big Data: Big Data can be structured, or unstructured, and are often exhaustive in scope, fine grained in resolution, indexical to enable identification, relational to allow co-jointing different datasets, and are often flexible, and scalable.

According to Kitchin (2014b), sources of Big Data include, but are not limited to, data from digital devices,[1] sensors,[2] scan data,[3] interaction data,[4] volunteered data,[5] data

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[1]pp.90
[2]pp.91
[3]pp.92, e.g. barcodes.
[4]pp.92
[5]pp.93

from online transactions,[6] social media,[7] sousveillance and self-monitoring technologies and practices,[8] crowdsourcing,[9], citizen science,[10] as well as directed data,[11] and automated data.[12] Many of Big Data datasets are 'relatively benign,' for example, the data in relation to weather measurements, or physical data from environmental sensors (Kitchin, 2014b, pp.15). In some cases, these data might be sensitive. For example, capturing human activities and interactions with technologies in real time could be used to reconstruct a detailed picture of the daily lives of individuals and groups online (Kitchin, 2014b). Data that are not sensitive in nature are sometimes framed as public good, enabling them to be accessible by public (Kitchin, 2014b). Other data might be framed as commodity, and business asset by commercial actors.

Big Data come with promises about their analytical potential for research in a wide range of sectors (Cukier and Mayer-Schoenberger, 2013). There are various governmental and business rationales behind the use of Big Data, as their technologies enable linking datasets together, facilitating better management by providing an overview, enabling observing patterns of anomaly. The applications of Big Data therefore, as Kitchin (2014b) notes, range from governing people and organisations [pp.114-119] to financial strategies for corporate intelligence, and improving cities, for example by studying pollution data, traffic congestion, disaster mitigation, and how they can become more liveable and sustainable places [pp.123-125].

As a result, Big Data technologies and practices grew fast in a relatively short period of time, and were introduced to existing practices of knowledge making (boyd and Crawford, 2012; Lury and Wakeford, 2012; Ruppert, 2013), and various aspects of our lives from research to business, politics to work, and consumption, and used by a wide range of actors, from governments to businesses, and the third sector (Kitchin, 2014b). As the technologies, and practices underlying Big Data are increasingly entangled in our lives, there have been questions surrounding their technologies and practices (boyd and Crawford, 2012; Kitchin, 2014b) some of which are detailed in what follows.

4.1.1   Promises and challenges of Big Data for social science research

Deterministic explanations of the role of Big Data in society can lead to oversimplified stories about their relationship, and trigger utopian or dystopian imaginaries. However, there are a range of nuanced critical questions surrounding the use of Big Data for

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[6]pp.93

[7]pp.94

[8]pp.95 e.g. health and fitness data.

[9]pp.96

[10]pp.97

[11]pp.88-89, Accoring to Kitchin (2014b), directed data extends traditional governance regimes for effective governance and administration.

[12]pp.89, According to Kitchin (2014b) automated data enables new regimes of regulation and automated management with little human oversight.

understanding the social world, and decision making (boyd and Crawford, 2012; Seaver, 2013; Kitchin, 2017; boyd et al., 2014; Gillespie, 2014b; Diakopoulos, 2015; Kitchin, 2017). In what follows, some of the questions about the implications of Big Data for social science research are explored as a means to contextualise the more nuanced questions and concerns that is important for better understanding the concerns surrounding OBTA.

Big Data come with potentials for research in the social sciences. Systematic generation of large amounts of data and metadata including 'social data' (Manovich, 2011), could be used in combination with other data types and processes to better understand populations and groups. Meanwhile, there are questions about the promises, and challenges of Big Data for established ways of knowledge making in the social sciences (Savage and Burrows, 2007; Burrows and Savage, 2014). Savage and Burrows (2007) question the implications of privately-owned digital data and Big Data methods on empirical sociology and sociological expertise (Savage and Burrows, 2007) and their claims to social knowledge (Burrows and Savage, 2014, pp.2).

This includes concern surrounding hyperbolic claims that suggest that the new possibilities of Big Data for empirical research means 'the end of theory' (e.g. by Anderson (2009)). Such claims are often critically examined and challenged. For example, Kitchin (2014a) delineates empirical only methods, with data-driven methods that combine Big Data empiricism with other inductive, deductive, and theoretical approaches, challenging the hyperbolic claims about the capabilities of the former by discussing its fallacies. Similarly, Beer (2009) challenges hyperbolic rhetorics on the democratising powers of Big Data.

Nonetheless, sociologists hope that new forms of digital data, and the more nuanced application of them can provide new opportunities for research in the social sciences (Savage and Burrows, 2007). Often constructive, innovative (Lury and Wakeford, 2012; Halford and Savage, 2017), and situated approaches (Kitchin, 2014a) are considered an opportunity for creating new forms of knowing in sociology (Ruppert, 2013; Kitchin, 2013), and for increasing capacities for action (Couldry and Powell, 2014, pp.2). Moreover, Big Data technologies, and practices can be used to find correlations, and patterns that can then be evaluated by academic researchers (Ruppert et al., 2015), hence, enabling data-driven research as opposed to being solely rooted in empiricism (Kitchin, 2014a, pp.137). Hence, Big data are appealing to STS research (Latour, 2011).

Meanwhile, despite the promising potentials of Big Data for new forms of knowledge making in social sciences, the outcome largely depends on when, and where Big data are used, how situated the knowledge made with their tools, and methods are, under what conditions their users are engaged with them, how the limitations of the data are accounted for, and how reflexive their practices are. Big Data can be enacted through divergent, and competing interests, and visions that, continuously reproduce it. As Ruppert et al. (2015, pp.30) highlight, Big Data are therefore not fixed, unified, consistent, or coherent.

They are instead, in a state of continuous re-production as they are performed, and enacted differently by different heterogeneous relations. Therefore, having reflexivity about ontological, epistemological, and methodological assumptions of Big Data technologies and practices can help provide a more realistic picture of their capacities, and limitations.

Based on the integrated theoretical approach adopted in chapter 2, in this thesis Big Data are considered as sociotechnical phenomena. This enables moving away from fetishizing Big Data, whilst acknowledging that Big data are not neutral, and value-free. In particular, the works of Donna Haraway here, is inspiring for thinking that sociology can benefit from situated approaches to using Big Data: This means not rejecting Big Data, whilst acknowledging that that working with them requires awareness of their assumptions, and limitations, situating their standpoint; and paying attention to data, methods and theory (Halford and Savage, 2017, pp.1140).

4.1.2 Critical questions surrounding algorithmic knowing and decision making

With his concept of 'post-hegemonic power', Lash (2007b, pp.71) highlights the cultural and social significance of algorithms. In computer science, algorithms are understood as a set of processual steps taken on an input to produce an output (Williamson, 2016, pp.7). However, as detailed in chapter 2 in a broad sense, in STS, digital sociology, software studies, and critical data and algorithm studies technologies are often understood as 'sociotechnical' (Beer and Burrows, 2013; Fuller, 2008; Kitchin, 2014b; Lupton, 2014). Technological innovation is considered inseparable from its social, and economic milieu that mutually shape each other and co-evolve together. Based on this understanding, it can be argued that purely technical definitions of algorithms risks over-simplifying their sociotechnical complexity. Therefore, in the field of critical data and algorithm studies, 'algorithmic systems' are understood to be shaped by social processes, whilst at the same time, effecting how social processes can be enacted (Gillespie, 2014a). In this thesis, reference to algorithm is based upon such understanding.

For Lash, as Halford et al. (2013, pp.177) note, algorithms provide not only an 'opportunity for invention but also a route through which power to define and know is mobilised (however unreflexively)'. Lash (2007b, pp.71) suggests that exploring how the power to define and know is mobilised in the 'new new media' (Lash, 2007a), requires a more nuanced approach than the older concept of 'power-as-hegemony' that was the focus of the British cultural studies. He argues that instead of coming from outside and through ideology, this new form of power is 'post-hegemonic,' coming from within individuals' everyday lives (Beer, 2009). He proposes that in the age of post-hegemonic power, cultural studies should increase their engagement across the disciplinary and stakeholder boundaries, and engage more with politics and practice to be able to make the necessary critical interventions (Lash, 2007b, pp.74-75).

Building on this, Beer (2009) explores post-hegemonic 'power through the algorithm' in the context of Web 2.0 to explore this new form of power in the context of the rhetoric of 'empowerment' and 'democratisation' embodied in the discourses around Web 2.0 [pp.986]. He builds upon Lash (2007b,a) and others to suggest that information technologies are not neutral mediators, but rather, they can have implications for human agency in how social processes are enacted. In other words, as Burrows suggests, they key point here is that our social interactions and associations are effected by software and code, that tend to 'constitute' and 'comprise' as opposed to solely mediating them (Burrows, 2009, pp.451).

Beer (2009, pp.997) emphasises that this does not mean that individuals are passive, powerless, unable to use this algorithmic power in a different way than what is instructed, or exercise other forms of agency. Instead, he draws on others to argue that the key concern here, is that the ways in which software and code shape our agential capacities to define, know, and structure this knowledge is often in 'concealed ways' (Beer, 2009, pp.988). For example, in 'social processes where (human) judgment matters' (Gillespie, 2017, pp.63), it is important to know how some patterns of information might be prioritised to others that might be different from the judgement of human decision makers (Barocas et al., 2013; Beer, 2009; Gillespie, 2014c; Kitchin, 2017; Gillespie, 2017).

Therefore, there are concerns surrounding the ability to see the effects of algorithms on our agential capacity to define and know: Mediators can themselves come with affordances (Latour, 2005) that can have implications. Whilst there is human agency for reflexive usage and re-appropriating technologies in different ways, the ways in which the material shapes the social might not always be visible, and be 'more difficult to unmask' (Beer, 2009, pp.993). It would be therefore, difficult to become aware if and how the technical processes come to influence the social. In other words, there is agency in both social and technical, as they operate together and condition each other. The concern at hand here, is if this conditioning- particularly on the side of technical on social- might remain invisible (Graham, 2005, pp.10).

This raises a question that how the 'material infrastructures of Web 2.0' (Beer, 2009, pp.1000) can be studied and scrutinised. Applying this to the context of OBTA re-emphasises the importance of a sociotechnical exploration of its technologies and practices, that is the research question asked in this thesis. With this context, the following sections highlight some of the concerns surrounding data and algorithms that are relevant to understanding the concerns surrounding OBTA.

4.2   Bias, inaccuracies, and lack of reflexivity

The term 'bias' is defined and used differently in different disciplines. From a technical perspective, bias can refer to 'deviation from a standard' (Danks and London, 2017,

pp.4692). In social sciences, bias can be considered a specific error, 'where the data are skewed due to a consistent pattern of error' (Kitchin, 2014b, pp.14). Moreover, from a sociological perspective, the term might be used to refer to lack of reflexivity and claims to neutrality and objectivity of the data and algorithms.

Danks and London (2017) note that when used in a purely technical capacity, algorithmic bias is not inherently undesirable. For example, bias might have intentionally been introduced to impose restrictions on the input or training data as certain input variables might not be legally allowed to be used for certain decisions (Danks and London, 2017, pp.4693). They add that treating bias in its technical capacity as something inherently bad to be avoided, can lead to discriminatory outcomes. Therefore, different forms of bias cannot be treated similarly: Whilst some of them might be problematic, others might be 'valuable components of a reliable and ethically desirable system' [pp.4692].

Bias can stem from application or interpretation of data and algorithms (Danks and London, 2017, 4696), research tools and methods, sampling or processing techniques, or the ideological or aspirational stance of the researcher (Kitchin, 1996, 2014b). It is therefore suggested that a contextual approach to understanding bias in relation to societal and legal values is more suited to the complexity of the situation that may be otherwise oversimplified by techno-fixes (Danks and London, 2017).

Examples of the implications of algorithmic bias can be seen on a range of algorithmic decision making domains from OBTA (Sweeney, 2013) to criminal sentencing (Angwin et al., 2016). For example, in relation to the former, a study by Sweeney (2013), the former chief technologist at the FTC, explored ad delivery in Google.com and Reuters.com searches, and found that search for racially-associated names indicated racial bias in delivering ads suggestive of arrest records [pp.44-45].

A possible explanation could be that the algorithmic processes that where matching ads to queries could have been trained on historical click data that reflect existing societal biases, and therefore, the search algorithms were reproducing these prejudices (Sweeney, 2013, pp.52). Resolving such biases would require knowing the inner working of the OBTA operations, and engagement with experts who are aware of the historical inequalities, to account for them in the future technologies (Sweeney, 2013). Meanwhile, Sweeney (2013) notes that although technology can lead to discriminatory outcomes, it could be used to prevent such outcomes exemplifying the works of Dwork et al. (2012).

An example of bias in criminal sentencing can be seen in the on-going debates about racial bias surrounding recidivism algorithms. Propublica reported that their investigation on a sentencing model called COMPAS indicated potential bias in the model (Angwin et al., 2016). The firm that had developed the model, Northpointe, disputed these suggestions using a different criterion for evaluating fairness (Dieterich et al., 2016). This sparked ontological and epistemological debates across disciplines on what is fairness and unfairness and how they should be operationalised and measured in such investigations

(Larson et al., 2016; Corbett-Davies et al., 2017; Zafar et al., 2017; Chouldechova, 2017), and whether resolving them involves trade-offs (Feller et al., 2016; Kleinberg et al., 2017).[13]

Meanwhile, the wider discussions about algorithmic bias, include debates surrounding the claims of neutrality and objectivity in data and algorithms, where algorithms are perceived as 'objective sources' (Caplan et al., 2018, pp.8-9), and the social and political implications of such claims. The critiques come from the premise that Big Data technologies and practices are not separable from the social, and therefore, are not neutral or immune from the biases of the social world, inaccuracies, mistakes, and misuses (boyd and Crawford, 2012), that if not considered, can have implications (Barocas and Selbst, 2016; Eubanks, 2017). For example, many have argued that data are not raw (Gitelman, 2013), inherently 'pre-analytical' (Kitchin, 2014b, pp.20), or neutral (Neff, 2013), and nor are the processes of defining and classifying them (Bowker and Star, 2000).[14] If historical biases are not taken into account, technologies can mirror and magnify existing social issues such as inequalities on scale (Barocas and Selbst, 2016; Eubanks, 2017). One reason for this is that when the data used for training algorithms embeds structural inequalities, the biases in the data can be transferred to the algorithms (Barocas and Selbst, 2016, pp.671). For example, Caliskan et al. (2017, pp.1-2) found that when 'ordinary human language' is applied to standard machine learning in widespread use, the existing cultural and historical biases can get replicated and propagated to AI technologies. Similarly, a study of Google ads by Datta et al. (2015) found that significantly fewer women than men were targeted and shown job ads that promised high salaries. Avoiding such issues requires a contextual understanding of the existing historical conjunctures and social inequalities through engagement with the domain experts to put in place safeguards for discrimination and widening inequalities. This is subject to ongoing cross-disciplinary research (Dwork et al., 2012; Hajian and Domingo-Ferrer, 2013; Barocas, 2014; boyd et al., 2014; Sandvig et al., 2014; FATML, 2014; Kroll et al., 2017; FAT Conference, 2018). In what follows some of the concerns surrounding discrimination, exclusion, redlining and re-enforcing social inequalities are detailed.

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[13]Northpointe's COMPAS score, is a proprietary black box model for predicting risks of recidivism. COMPAS became scrutinised by journalistic and academic investigations for racial bias (Angwin et al., 2016; Corbett-Davies et al., 2017; Chouldechova, 2017; Zafar et al., 2017). Northepointe disputed racial bias arguing that race was not used as input and criticising ProPublica for the choice of fairness criteria chosen for exploring bias (Dieterich et al., 2016). Northpointe suggested that the correct way to check for bias is by a fairness criterion called 'predictive parity' [pp.2], arguing that COMPAS satisfies this criterion (Dieterich et al., 2016). However, as others argued, parity is an inappropriate criteria for fairness and does not protect against racial bias particularly when applied to populations that have historically been subject to systematic inequalities (Chouldechova, 2017), highlighting the need for understanding the historical social context in each and every application of data-driven risk assessment, and necessary adjustments to avoid biases that can lead to disparate impacts (Chouldechova, 2017).

[14]Classification of content, ad products, and 'audience' (ie.web users) into taxonomies, is a crucial part of OBTA (Gallo, 2016)

4.3   Discrimination, exclusion and redlining

The claims of objectivity of data and algorithms including OBTA have been challenged in the past few years with evidence suggesting that they can discriminate for example, by gender (Datta et al., 2015; Kay et al., 2015; Caliskan et al., 2017; Lambrecht and Tucker, 2018) and race (Sweeney, 2013; Angwin et al., 2016; Parris Jr and Angwin, 2016). This section introduces some of these examples and showcases the depth and breadth of ongoing journalistic and academic research from computer science, STS, and critical data and algorithm studies for preventing and detecting such issues. It is concluded that in some cases, understanding the causal reasons behind such incidents in OBTA requires more transparency in the operational details of the OBTA ecosystem to enable empirical research.

Big Data are not only appealing to academic social science research, but also, to commercial social science, and market research, particularly in the marketing, and advertising sector(Kitchin, 2014b). In the past, marketing and advertising practices tended to use generic classifications where households were categorised into large segments and aggregate profiles to target them with marketing and advertising messages that were perceived more relevant to them. More recently, these practices may employ predictive profiling and other profiling methods that gather personal data such as clickstreams, social media posts, etc. for market research (Kitchin, 2014b, pp.176). On the one hand, highly individualised targeted ads based on predictive profiling might be appealing for customers due to convenience. However, on the other hand, there are concerns and questions about the application of data and algorithms in ways that can lead to exclusion and discrimination (Sweeney, 2013; Calo, 2013; Ramirez et al., 2016; Calo, 2011; Solove and Citron, 2016; Noble, 2018), and in ways that are not always visible (Pasquale, 2015; Citron and Pasquale, 2014; Dixon and Gellman, 2014; Pasquale, 2014). This exacerbates concerns about discriminatory marketing practices that use algorithms and profiling techniques to differentiate offers and products to different social groups (Turow, 2008). For example, predictive profiling can be employed for providing preferential treatments to particular customer categories, whilst marginalising others in ways that makes it challenging to scrutinise the 'grounds for discrimination' (Kitchin, 2014b, pp.176);(Graham, 2005).

It is important to note that such practices have started prior to the arrival of Big Data (Sandvig et al., 2014). However, it is possible that Big Data practices provide new capacities for such operations on larger scales and in ways that are not always visible. Crawford and Schultz (2014) highlight another point, that prior to Big Data the information used for targeted advertising were more likely to be based on deterministic information as obtained directly from consumers, whilst Big Data enables using probabilistic information that could be analysed without consumers' knowledge.

An example of this is reported by Valentino-DeVries et al. (2012) in the US, whereby their reverse-engineering of a retailer's dynamic pricing mechanisms found that the retailer's

differential pricing method inferred consumers zip code and their proximity to the nearest competitor store for targeting them with differentially priced ads. For example, discounts were targeted to those living closer to competitor stores. Such methods can reinforce existing social biases in poor areas that tend to have less competition, challenging the equalising promise of the Web (Valentino-DeVries et al., 2012).

Differential pricing based on profiling can lead to 'price discrimination' if high prices mean that a person is in effect, excluded from certain goods and services (Zuiderveen Borgesius and Poort, 2017). In a study by Mikians et al. (2012, 2013) strong possibilities of this and 'search discrimination' was suggested based on consumer data such as location and browser configuration. As Zarsky (2018, pp.30) highlights, the economic implications of slight changes to price through ads might be benign, however, the 'symbolic impact' of this could be significant for social groups. Moreover, there are concerns surrounding digital redlining; 'digital decisions' that can 'enact new modes of racial profiling' (Noble, 2018, pp.1).[15]

Moreover, there are concerns surrounding exclusion of social groups from ads that can be considered as offers and opportunities (Crawford and Schultz, 2014). Exclusion from these types of targeted ads can therefore raise concerns about discrimination and re-enforcing inequalities. In 2017, a number of journalistic reports suggested that that platforms allowed advertisers to target users or exclude them from targeted ads based on race and age (Parris Jr and Angwin, 2016; Angwin et al., 2017). Redressing 'missed opportunities, such as a real estate offer one never sees because Big Data might have judged one unworthy' would require a 'structural due process approach' that are currently lacking (Crawford and Schultz, 2014, pp.125).

Moreover, there are concerns surrounding indirect forms of discrimination. This is because insensitive data or data that is not prohibited by anti-discrimination laws, can act as proxy for sensitive information (Kosinski et al., 2013). Therefore, data and segments do not have to be sensitive to raise questions on discrimination, which makes conventional anti-discrimination laws no longer enough for preventing algorithmic forms of discrimination (Barocas and Selbst, 2016).

Moreover, in some cases, targeting criteria appears neutral and it is not clear how discriminatory results are produced (Lambrecht and Tucker, 2018). As a result, various studies have explored the causal reasons behind discrimination in bahavioural advertising (Sweeney, 2013; Lambrecht and Tucker, 2018; Datta et al., 2015). Detecting the reasons behind certain outcome and exploring how they can be prevented requires empirical research on OBTA operations (Zuiderveen Borgesius et al., 2018; Anstead et al., 2018). However, access to such data for academic and journalistic research purposes has been restricted (Bruns, 2018). This makes investigating the extent of issues and how

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[15]Redlining includes practices specific to lending loans, mainly in location with large minority population (Turner and Skidmore, 1999, pp.12).

they can be prevented very challenging. The ephemeral nature of ads means that they can only be visible to their target groups, adding to these challenges. As a result, crowdsourcing efforts have been launched to create public archives of ads that can facilitate research and investigation (Larson et al., 2017). However, crowdsourced data on targeted ads can come with sample skew as it is possible that only specific social groups opt-in to take part in such research. Therefore, a more productive approach would be for OBTA companies to enable academic research on their operational details.

4.4 Privacy harms

The concept of privacy and rights to privacy is imagined differently, and enacted based on different political or philosophical underpinnings (McStay, 2017, pp.18-99). McStay (2017) exemplifies some of privacy's different political framings: for example, there is an individualistic framing of privacy that can involve anti-democratic and monopolistic behaviour (pp.64). Another framing focuses on self-respect and dignity valuing the experiences both individuals and groups (pp.19). Meanwhile, some consider privacy as a form of power (Kaltheuner, 2018), or focus on its collectivist characteristics (Fuchs, 2012, pp.140), and public value (Regan, 2009, pp.xv). In relation to the Web, some highlight the importance of what is visible from one's online interactions (Marwick and boyd, 2014), how and when this information is accessed (Rainie et al., 2015) or used by others (Lanier and Saini, 2008). Therefore, privacy is a multifaceted concept that can serve a wide range of political values that might be overlapping or competing, depending on where and when it is provoked.

In the more recent years, there have been academic projects such as 'Reframing Privacy' by boyd et al. (2016) to bring the concerns of those more vulnerable to privacy harms into the agenda of privacy debates. For example, a study by Madden et al. (2016) explore the relationship between class differences and being 'privacy vulnerable'. They investigate how targeting and predatory marketing affects 'privacy vulnerable' groups, recommending technical and non-technical reforms that pay more attention to the concerns of low-income communities and social groups.

Meanwhile, there are polls that show that in a broad sense, web users are concerned with privacy (King et al., 2011; Balebako et al., 2013; Bilogrevic and Ortlieb, 2016), control over their information (Madden and Rainie, 2015, pp.5), and fairness (Kennedy et al., 2017). As a result, privacy harms have been the focus of policy debates in the past decade (Calo, 2011; Crawford and Schultz, 2014; Tufekci, 2015; Kitchin, 2016; Solove and Citron, 2016). The area of focus of debates are sometimes limited (FTC, 2010, pp.iii), whilst academic research has been proposing new theoretical frameworks, and discussing the limitations of the conventional models. For example, Calo (2011, pp.1) conceptualises privacy harm in two categories of objective harms and subjective harms,

where the former refers to 'coerced' use of one's information, and the latter is caused by a 'perception of unwanted observation.' In another example, Crawford and Schultz (2014) suggest that predictive profiling and new ways of inferring information that Big Data enables can mean that personal harm may no longer fall within conventional boundaries recognised for privacy intrusion (pp.94-95), shifting the attention to discriminatory practices that circumvent current regulations (pp.99). Moreover, Solove and Citron (2016) argue that data breach harms (including non-consensual personal data sharing) often have characteristics that are recognised in other areas of law in the US judicial system, and hence, propose an approach for applying them. Moreover, in a keynote speech in 2017, Kate Crawford reported on a research co-authored by Wallach and Barocas to make a distinction between allocative and representational harm (Crawford, 2017). The former is a harm that leads to a quantifiable economic loss such as losing a job, whereas the latter is about reputational harm that leads to a harmful representation of identity of an individual, a community, or a group of people (Crawford, 2017).

A taxonomy of privacy harms is provided by Kitchin (2016, pp.25-26) that brings together four main categories of 'information collection', 'information processing', 'information dissemination', and 'invasion', drawing on Solove (2006). Each category is associated with a number of privacy breaches. The first category, 'information collection' mainly focuses on collecting information from an individual without their knowledge or consent. The second category, 'information processing', is associated with privacy breaches such as 'aggregation' of various sources of data about an individual and their 'identification', 'insecurity' that can lead to leakage of their information, 'secondary use' of their data in non-consensual ways, and their 'exclusion' from information about how their data is processed and used. The third category, is associated with seven sub-categories of privacy breaches from breaching confidentiality to distortion of an individual's information. And the fourth category, 'invasion', is associated with 'intrusion' and 'decisional interference' (Kitchin, 2016, pp.25-26).

Examples of concerns on the above categories of privacy harms surrounding OBTA can be widely found in the academic and grey literature. For example, there have been questions and concerns about non-consensual practices (Calo, 2011; Crawford and Schultz, 2014), circumvention of legal safeguards such as equalities of opportunities, or exclusion from access to resources and opportunities (Crawford and Schultz, 2014), and the tendency for revealing more than it was disclosed (Tufekci, 2015, pp.209). In what follows, the 4 main categories of privacy harm compiled by Kitchin (2016) are explored in relation to the concerns surrounding OBTA technologies and practices, starting from 'information collection'.

When a web user visits a Web page through their Web browser, the content appears in the form of a single page, whilst there might have been resources on several other pages that were drawn together to form that page. As the experience is seamless to the web user, they might not notice that they are actually interacting with several websites and not only

one website, each of which can employ OBTA. Therefore, although it is possible that both the first-parties and the third-parties that operate on that web site have obtained consent, yet it is possible that the consent has not been meaningful. Moreover, it is possible that data collection has been non-consensual. Examples of the latter were detailed in Chapter 3 in introducing evercookies (Acar et al., 2014, pp.674), respawning techniques (Soltani et al., 2010) and misuse of various forms of client storage (ETags, HTML5, and Flash LSO) to circumvent users attempts to clear their cookies. Additionally, there are security vulnerabilities such as cross-site scripting (XSS) and cross-site request forgery (CRSF or XSRF) that can enable an 'unauthorized and unrelated "third-party "' to retrieve information on the first-party website (Mayer and Mitchell, 2012, pp.413).

There are also similar concerns surrounding identification technologies and practices. For example, SilverPush is a software that uses inaudible beacons to synchronise the identity of a mobile device with a TV that are in close proximity to each other. This would enable cross-device ad targeting between the mobile device and the TV without notifying users (FTC, 2016).

More generally, researches warn that the oxymoronic notion of 'anonymous identifiers' that is sometimes used by OBTA companies can be misleading (Lane et al., 2014, pp.52-53). Also, identifiers that impact privacy are not limited to sensitive types of identifiers, and that sensitive attributes can be inferred through other means that can single out individuals and groups (Narayanan et al., 2016, pp.2). Additionally, there are concerns surrounding consolidation, whereby the collected data is merged with data from external sources. Various data brokers maintain offline database that might be based on 'loyalty programs, store transactions and call-center interactions' whilst there is also the possibility of company mergers (Kaye, 2014). It is suggested that sometimes anonymisation may not be enough, where through a variety of mechanisms including inferences, or database merges, anonymised data might be re-identified (Narayanan and Shmatikov, 2008). Meanwhile, Stalla-Bourdillon and Knight (2016, pp.12) argue that anonymised/personal data should not be considered as fixed binary as they can evolve into each other depending on the context, and their boundaries are fluid. Instead, they advocate for a dynamic and contextual approach to anonymised data.

In addition to identification, there are concerns about privacy harms rising from other aspects of information processing. For example, as McStay (2017, pp.123) points out, in many cases privacy concerns are not about possession of an individuals data by a company. Instead the concerns are about to what uses that information is put. For example, there are concerns surrounding the exploitation of OBTA technologies and practices for market manipulation (Calo, 2013) and 'vulnerability-based marketing' (Pasquale, 2015, pp.197). Calo (2013, pp.999) argues that exploiting behavioural and psychological vulnerabilities can lead to both objective and subjective harms.

In addition to the above, there have been security concerns surrounding OBTA. For example, a study by Krishnamurthy and Wills (2010) found that OSN identifiers could be leaked through referer header (pp.9), enabling third-party aggregators to link users private data with third-party profile information gathered from their online behaviour on a non-OSN website (pp.9). Similar leakages were also found on popular non-OSN websites (Krishnamurthy et al., 2011). Moreover, third-party form builders can enable exfiltering users data when it is entered into the form by third parties (Starov et al., 2016). Englehardt (2018, pp.29) also found exfiltration of personal data by tracking and analytic scripts on the Web.

There are privacy concerns about leakage of information such as browsing history and search queries from some browser plug-ins to third-party servers (Starov and Nikiforakis, 2017). There are also similar concerns about the leakage of users browser history during the processes of Real Time Bidding (RTB) and Cookie Matching (CM) in ways that are invisible for the users and are difficult to detect using common tracking monitoring tools (Castelluccia et al., 2014). There are also concerns about privacy breaches and leakages in the process of server-to-server communications (Acar et al., 2014). Meanwhile, practices such as 'browser history stealing' might be employed by websites to link styling to identify user's browser history (Mayer, 2011c). There are similar privacy concerns surrounding CSS-based history detection based on visited link colouring (Janc and Olejnik, 2010).

4.5   Click-fraud, brand damage, market concentration and spread of problematic information

From the perspective of OBTA companies, there are also concerns surrounding OBTA including click-fraud that is considered a major threat to the growth of ad brokers revenue (Haddadi, 2010). When bots are programmed to click on ads instead of legitimate web users for generating revenue, advertisers and brokers are harmed, for example from an economic and/or reputation perspective (pp.276).

Haddadi (2010, pp.1) describe click-fraud as a subject of controversy: For example, click fraud might profit the broker; the advertisers might be interested in claiming all clicks as fraud to avoid payments; and the publisher might have incentives to hire human or botnet click-fraudsters to generate more revenue. Haddadi (2010) propose a set of ads designed to motivate bot-clicks for authenticating user clicks from bot clicks and detecting false positives.

In addition to click-fraud, brand damage is an industry concern. One of the occasions that such concerns are materialised, is cases of inappropriate matching of ads and content. In many cases, ad brokers compile lists of the type of ads that each publisher would accept on their websites. They might have similar lists from advertisers on the type

of content that they would/would not approve to sponsor. However, in the past years popular media has reported occasions where, the processes of matching ads and content has led to inappropriate ads (Murphy et al., 2018) that consequently, faced reactions from industry(Hern, 2017).

Meanwhile, there are concerns surrounding the concentration of activity in OBTA markets. A study by (Gomez et al., 2009, pp.23) found Google to be the most dominant tracking firm (More than 80% of their sample). A similar study by Altaweel et al. (2015), as well as a non-academic report by (knowyourelemets.com, 2014) supported these results. Similarly, a report by Mary Meeker (2017) from the venture capital firm Kleiner Perkins in 2017 suggested that Google and Facebook together generated more than 85% of online advertising revenue growth.

Moreover, with increasing concerns over media manipulation, the spread of problematic information, and computational propaganda on the Web (Marwick and Lewis, 2017; Del Vicario et al., 2016; Forelle et al., 2015; Woolley and Howard, 2016; Bradshaw and Howard, 2018) there are questions on if and how OBTA technologies and practices might be exploited for such purposes. Relevant debates about these questions are detailed in what follows by drawing on academic literature and popular media.

Matching search queries to relevant search results requires organising available information such as URLs, images, etc., building statistical models to identify and prioritise content based on 'previous patterns found in training data that are used to define a successful outcome' (Golebiewski and boyd, 2018, pp.1). These patterns might be based on a range of variables including the content of the web page and metadata associated with the page (e.g. title of the page), previous user interactions with search results (e.g. clicks), and other variables such as location, etc. (Golebiewski and boyd, 2018, pp.2). The identification and prioritisation of search results is very important as in many cases, web users might only engage with the first page of search results (Golebiewski and boyd, 2018).

When there is not enough data for a search query, the processes of identification and prioritisation of content becomes vulnerable to alterations and manipulation, be it through matching queries to search results, or through targeting ads to search queries for search advertisement (Golebiewski and boyd, 2018, pp.1). In their report, Golebiewski and boyd (2018, pp.1) describe a sociotechnical phenomena called 'data void,' where, data relevant to search terms is 'limited, non-existent, or deeply problematic', making matching queries to results exploitable. The authors argue that in some cases, it is possible that a 'manipulator' motivated by an agenda, leaves trails of 'problematic search terms' on other pages using basic search optimisation techniques to 'guide' web users to these terms (pp.3). An example of this phenomena is mentioned in a Wired article by DiResta (2018) where, it is suggested that a 'data void' in the search terms common amongst new parents is exploited by anti-vaccination misinformation campaigns to propagate anti-vaccination

ads, raising concerns about the legitimisation of health misinformation by search and social ranking algorithms.

4.6   Trust

OBTA technologies and practices are one of driving economic forces for generating online content and services on the Web. However, surveys show a decline of trust in OBTA. For example, in 2017 a report by Ipsos MORI commissioned by Trinity Mirror suggests that 69 percent of their UK participants claim to distrust brands and advertising (Tenzer and Chalmers, 2017). The impact of the decline of trust can be significant for a wide range of websites and online businesses.

The reason for decline of trust cannot be easily determined. This is because trust in OBTA is inextricably linked with a wide range of sociotechnical phenomena that cannot be studied in isolation from each other, and the impact on trust might be co-produced by the wider social, economic, political relations. However, it is suggested that the opacity in the operations of OBTA has contributed to the decline of users trust in OBTA (Eslami et al., 2018) and that building more positive relationships with consumers for OBTA companies requires clear communication of their operational details (Tene and Polonetsky, 2012; Ur et al., 2012; FTC, 2013; Eslami et al., 2018). As a result, clear communication of operational details in OBTA can be considered a trust-building mechanism. In what follows discussions surrounding this subject in the wider domain are detailed.

A/B testing is a routine practice by websites whereby, randomised tests are performed to measure user experience and adjust the arrangement and order of the elements of their web pages. In many cases AB/testing is benign (Reisman, 2016), however, in at least one case (Kramer et al., 2014), they sparked extensive debates in academic circles and on popular media (boyd, 2014; Gillespie, 2014a; Crawford, 2014). Although the context of A/B testing is different from OBTA, however, the overlap on market research means that the lessons learnt from the discussions surrounding it can be applied to the context of OBTA.

With regards to the discussions mentioned above, Metcalf (2015) highlighted that Big Data firms face a critical moment that necessitates learning about the history of building social trust from other disciplines, suggesting that in other domains 'it is hard-won trust that facilitates the move between practice and research,' which makes investing in trust-building as important as accuracy, or the novelty of algorithms and technologies for sustaining web businesses (Metcalf, 2015). For example, social scientists, physicians, and researchers from a wide range of disciplines that are engaged with researching human subjects, have historically established procedural safeguards and commitments that makes them trustworthy for their research participants (Metcalf, 2015). This 'hard-won'

trust now enables experts in these disciplines to conduct research. Similarly, academic researchers often have to comply with ethical principles at their institutions before researching or experimenting on human subjects, even if the ultimate purpose of the research is for public good (Calo, 2013, 1045-1046). However, such mechanisms are often lacking in the operations of Big Data firms. Although it might not be possible to directly copy the formula for trust from other disciplines to data-driven technologies and practices, they can guide data-driven companies for building trust (Metcalf, 2015).

Metcalf (2015)'s points above can be applied to the context of OBTA. The decline of trust in brands and advertising hints to lack of trust building mechanisms. One way to make the necessary critical interventions in OBTA is to enhance operational transparency. For the purpose of this thesis, transparency refers to communicating operational details.

Enabling research can improve the state of concerns that can consequently have implications for trust. In the absence of trust-building mechanisms in OBTA (Stewart, 2017), there has been an impact on trust that go beyond the scope of consumer trust, and include OBTA stakeholders (Kint, 2014). Being trustworthy requires substantiating the claim through enabling investigation and research in response to questions and concerns and being responsive about them. Enabling research can help in identifying problems, investigating their implications, and re-dressing them.

4.7 Conclusion

This chapter introduced some of the critical questions in the wider domain of Big Data and Algorithmic decision making, and showcased some of the concerns surrounding OBTA both from the perspective of individuals/groups and OBTA industry. This section argues against deterministic explanations on the role of OBTA in certain political or social outcome, and joins the voices calling for operational transparency in OBTA. This is described in what follows.

The danger of focusing solely on the concerns surrounding OBTA and their harms is to trigger dystopian imaginaries, and forget about their benefits for the Web in enabling free access to online content and web services such as search. The theoretical approach adopted in chapter 2 enables acknowledging the benefits of OBTA for increasing accessibility to online production and web services, rejecting deterministic explanations about the causal role of OBTA in social and political outcomes, calling for a nuanced understanding of OBTA, and focusing on how the benefits of OBTA can be distributed in a way that do not re-enforce existing social issues such as inequalities when exploring approaches for making the necessary critical interventions in OBTA.

Meanwhile, there are questions about the effect of technical on the social in the context of OBTA, that are less nuanced. This includes concerns about the causal effects of targeted

political ads on particular political outcome, for example, at the time of elections. STS researchers have challenged the assumptions underlying deterministic explanations of the power of analytics and OBTA in shaping the social and political sphere in causal ways. For example, Marwick (2018) draws on theories and concepts from British cultural studies (e.g. Hall (1973)) to warn against arguments derived from a magic bullet theory of media that suggests media users passively receive and react to media messages.[16] Marwick (2018) instead suggests that particular social outcome, such as the spread of problematic information, is not external to the social or the technical and requires a sociotechnical lens capable of considering the economic, political, social, cultural and technical relations that cannot be separated, or understood in isolation from each other (Marwick, 2018, pp.510).

Similarly, Beer (2017) critically reflects on such concerns by questioning if analytics actually come with the powers that we are led to believe? For example, the data and processes may not be as accurate as they are sometimes perceived, or people may not be easily influenced by targeting technologies and practices (Beer, 2017). This all re-iterates the need for more nuanced approaches. Meanwhile, Anstead et al. (2018) conducted an empirical analysis of the content of targeted ads on Facebook during the 2017 UK General Election campaign. They found that ads were aligned with 'national campaign narratives' [pp.1].

As others have noted, dystopian imaginaries and oversimplified stories, can detract from the more nuanced transformations under way. However, not all OBTA is problematic and in many cases, concerns can be about when and where using OBTA can lead to undesirable social effects. There are also question on if and how OBTA technologies and practice are implicated in re-enforcing and widening social inequalities, or affecting users agency to avoid re-affirming their social and cultural biases on the Web amongst other critical questions. In this chapter, a range of concerns surrounding OBTA and the wider context were introduced from bias and inaccuracies, to privacy harms, and concerns about exclusion and discrimination. It was argued that undesirable social effects might be co-produced not only by problematic practices, inaccuracies, and mistakes, but also, from interlinked actions and the sociotechnical relations embedded in them that might be conditioned by a wider social, technical, political, and cultural context. This is because many social concerns such as inequality, discrimination, and other societal issues are not new or specific to technologies, but technological affordances can shape our agencial capacities in dealing with issues for better or worse. For example, OBTA technologies can exacerbate existing issues, bring them into light, or limit the ways existing issues could grow and get reinforced. Similarly, there are various OBTA practices that are not new or specific to OBTA. For example, differential pricing or retailer's manipulation of their search results for commercial interest is not a new practice (Sandvig et al., 2014, pp.2).

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[16]For more details see Sproule (1989).

However, there are questions about if and how the affordances of OBTA technologies can affect our agency in detecting and dealing with them in concealed ways.

As others have argued, answering such questions requires empirical research to help developing a better understanding of the sociotechnical relations that constitute OBTA, and operational transparency that can enable such research. For example, Anstead et al. (2018) in their research on the effect of political micro targeting on Facebook highlighted that developing an understanding of the role of Facebook in the political sphere, requires overcoming epistemological, conceptual, and systematic challenges that needs a lot more empirical research. Similarly, others have argued that questions about microtargeting political ads require a nuanced understanding of them (Zuiderveen Borgesius et al., 2018) that requires more research. Therefore, it can be argued that developing a nuanced understanding of OBTA that can facilitate the necessary critical interventions requires more empirical research on OBTA technologies and practices. Such research is currently challenging due to proprietary data, technologies, and methods and that technologies and practices are often opaque (Pasquale, 2015). Moreover, ads are ephemeral, and problematic ads might only be visible to those targeted.

A necessary critical intervention here is therefore to enhance transparency in OBTA operational details to enable empirical investigations. As a result, researchers have called for operational transparency in OBTA (Pasquale, 2015) to not only enable research (Zuiderveen Borgesius et al., 2018, pp.94-96), but also help re-building trust (Tene and Polonetsky, 2012; Ur et al., 2012; FTC, 2013; Eslami et al., 2018). For example, Bruns (2018) amongst others call for companies to provide an open API to academic institutions to facilitate academic investigation and research. It can therefore be concluded that there is a need for OBTA companies to enhance their operational transparency to facilitate research. This raises the question ***how can the transparency of OBTA operations be enhanced?*** The following chapter, aims to explore answers to this question by learning from the history of previous interventions surrounding OBTA.

Chapter 5

Previous interventions

The previous chapter explored the concerns surrounding OBTA as the first step towards a sociotechnical exploration of their technologies and practices. It was argued that there is a need for more empirical research that is currently challenging due to lack of operational transparency in OBTA. Providing transparency was defined and scoped as communicating operational details to enable research. It was therefore, asked ***how can transparency in OBTA operations be enhanced?***

This chapter aims to learn from the history of interventions in response to concerns surrounding OBTA and the wider domain, how a mechanism for enhancing operational transparency might look like. The chapter starts by exploring key themes in the interventions, and discussing their strengths and limitations. It is re-emphasised that transparency can be a red-herring if it is used as a replacement for safeguards. However, a type of transparency that can enable research for governance can be beneficial in addition to such safeguards. In looking for ways to develop a sociotechnical understanding of OBTA, it is therefore asked ***How can transparency in analytic and administrative operations of OBTA be enhanced in a way that can enable research?***

In looking for answers to this question, the ongoing work on algorithmic transparency and accountability in the wider domain of datafication and algorithmic decision making and their promises and challenges is explored. It is argued that communicating operational details by OBTA companies is more advantages than transparency mechanisms that aim to discover the operational details. The chapter therefore ends by asking ***how can the analytic and administrative operational details behind a targeted ad be communicated and documented in an interoperable way across different actor groups in a way that can enable research?***

5.1   A history of previous interventions

This section overviews some of the major themes in the previous interventions with an aim to learn from their history what could mechanisms for enhancing transparency in OBTA look like, and explore their promises and limitations.

From a legal lens, concerns about privacy harms are often covered under privacy law in the US, and data protection in the EU (Kitchin, 2016, pp.26);(Minelli et al., 2013). In the EU, the right to data protection is often seen different from the right to privacy, as data protection focuses on the conditions under which personal data are processed (EU General Data Protection Regulation, 2016). However, sometimes 'data privacy law' is used to refer to both the rules in the ePrivacy Directive or the new ePrivacy Regulation and in data protection law.[1] For simplification, in this thesis data protection law and privacy law are used interchangeably.

As Kitchin (2014b, pp.170) notes, in both US and EU cases, a common set of principles, called the Fair Information Practice Principles (FIPPs) have largely influenced these legislation. FIPPs were developed in the 1970s in North America and Europe, published by the Organization for Economic Co-operation and Development (OECD) in 1980 and different versions of them have since been adopted in different countries (Kitchin, 2016). For example, a 8-category version has been adopted by OECD, and a 4-category version is used by the Federal Trade Commission (FTC) in the United State (Kitchin, 2016, pp.26). Moreover, in the US the application of FIPPs are sector specific, whereas in the EU legislation applies to all domains. Kitchin (2016, pp.27-28) draws on Minelli et al. (2013) to describes these principles as follows.

- **Notice** requires informing individuals about the usage and processing of the data.

- **Choice** safeguards the option to opt-in or out of data collection and processing.

- **Consent** requires the data generation and processing to be only embarked on after consent.

- **Security** centres on protecting the individuals' data from misuse, loss, and various other security breaches.

- **Integrity** ensures that the data are 'reliable, accurate, complete, and current.'

- **Access** enables individuals to 'access, check, and verify data about themselves.'

- **Use** ensures that 'data are only used for the purpose of which they are generated and individuals are informed of each change of purpose.'

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[1]For example see J Zuiderveen Borgesius et al. (2017)

- **Accountability** makes the 'data holder' accountable for ensuring the above principles and has mechanisms in place to assure compliance.

According to Kitchin (2016, pp.35), 'opacity and automation' have undermined FIPPs in various ways. There has been various approaches to bring FIPPs back to light in the era of Big Data and Algorithmic decision making. Commonly derived models from FIPPs particularly in the US, include the 'notice and choice aproach' (FTC, 2010, pp.9) and a 'harm-based model' (FTC, 2010, pp.iii). Each of these models have considerably influenced data protection, yet both have been criticised for different reasons (FTC, 2010).[2] More recently, the ideas of 'information fiduciaries' (Balkin, 2016) has been proposed and is being discussed in the US. (Balkin, 2017, pp.1227) describe fiduciaries as 'professionals like doctors and lawyers, and people who manage estates or other people's property' (Balkin, 2016, pp. 1207) where there is a 'significant asymmetry in knowledge and ability between the fiduciary and client' (Balkin, 2016, pp. 1216-1217). It is therefore put forward that companies that use algorithms to classify and govern populations, have fiduciary obligations, as well as obligations about transparency, due process,[3] accountability and interpretability that are used for preventing or providing a remedy for harm (Balkin, 2017). Zittrain (2014, pp.339) explains Balkin (2016) 's concept further: Fiduciaries tend to collect a lot of information about their clients and are 'obliged not to use that information against them.'

There are various approaches to governance and regulation of privacy and data protection in the EU.[4] This thesis builds upon a definition of regulation that considers it inclusive of any public or private intervention including legislation, self-regulation, or multistakeholder approaches for intentionally aiming to influence others behaviour towards a desired outcome (Hofmann et al., 2017, pp.1418). Each of these approaches come with both strengths and weaknesses.[5]

The EU General Data Protection Regulation (GDPR) (EU General Data Protection Regulation, 2016) comes into force in May 2018. In general, the EU approach requires data processors and controllers to comply with its provisions, and requires web users to decide which practices should be permitted. In this sense, the EU GDPR is more focused on enforceable individual rights. The impact of GDPR on the state of consumer protection and accountability will be unfolded after it comes to force in 2018.

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[2]The critique on the notice and choice model will be detailed in the following section. The 'harms-based' model to privacy is sometimes criticized for its limited recognition of the scope of harm. For details see chapter 4.

[3]In this thesis due process refers to Crawford and Schultz (2014)'s description of data due processes.

[4]For example, a risk-based approach can be seen in the Directive 95/46/EC (WP, 2014) and is adopted under GDPR (Edwards, 2018). For another example, see UK's Information Commissioner's Office code of practice on anonymization (ICO, 2012; Edwards, 2018). Other approaches include a 'human-rights foundation' to privacy, a 'harms-based approach,' and a 'rights-based approach' to data protection.

[5]For example see Anderson (2012)'s critique of ICO's proposed risk approach. For debates about the shortcomings of some of the other approaches see WP (2014); Edwards (2018).

Notice and consent model constitute a key part of GDPR and ePrivacy Regulation (ePR) that are derived from FIPPs. The ePrivacy Regulation (ePR) (Commission et al., 2017) is set to replace the current ePrivacy Directive and at the time of writing this thesis is not yet finalized. The EU ePrivacy directive, focuses on protecting electronic communication online and has specific rules for maintaining the confidentiality of communications (Commission et al., 2017).

Moreover, as Zittrain (2008, pp.69) notes, scholarly work in this area sometimes calls for industry self-regulation instead of direct governmental regulation, as sometimes this type of regulation is considered 'more efficient or just,' or because direct governmental regulation might be difficult to achieve. Examples of self-regulatory proposals can be seen in the form of community standards surrounding OBTA, whereby, groups and standard setting bodies have engaged in developing best practices. An early example of such standards is Platform for Privacy Preferences (P3P) (Cranor et al., 2002) that was developed in 2003 by W3C and aimed to communicate compact policies in a machine readable format to the browser. In the absence of enforcement/redress (a component of FIPPs), studies found that many websites were communicating misleading, incomplete or incorrect information through P3P standard (Leon et al., 2010; Cranor, 2002). Just as misleading or inaccurate use of metadata, for example, using Dublin Core standard, could negatively affect search and discovery (Sokvitne, 2000), misleading privacy information could also affect how websites would be ranked based on their privacy policies.

Meanwhile there have been various community standards that have been successful. For example, robots.txt (Koster, 1996), is a standard through which website authors could signal their preferences about 'what parts of the site ought to be crawled and by whom' to robots (Zittrain, 2008, pp.102). Inspired by robots.txt in thinking about community standards in the context of privacy, Zittrain (2008) suggested a standard for respecting people's privacy choices. This proposal is similar to a IETF proposal for a standard known as Do Not Track (Mayer et al., 2011) that was then further developed at the W3C Tracking Protection Working Group into two specifications of Tracking Preference Expression (DNT) and Tracking Compliance and Scope (TCS) (W3C, 2011). What made DNT distinct from the rest of the previous interventions is its aim in employing both elements of policy and technology. However, unlike robots.txt, as of today, W3C DNT specification has not been successfully adopted by the OBTA actors. Meanwhile, depending on how the new ePR unfolds, browser vendors could be asked to set DNT:1 as default, in which case, DNT could be revitalized.[6] A brief history of Do Not Track is provided in what follows.

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[6]The proposed ePR by EU commission acknowledges the role of browsers in protecting consumers and aim to use this potential. The proposal (22 states: 'Web browsers mediate much of what occurs between the end-user and the website. From this perspective, they are in a privileged position to play an active role to help the end-user to control the flow of information to and from the terminal equipment. More particularly web browsers may be used as gatekeepers, thus helping end-users to prevent information from their terminal equipment (for example smart phone, tablet or computer) from being accessed or stored.'

The W3C Tracking Protection Working Group was created with an aim to enhance user privacy and control (W3C, 2011). This includes specifying the HTTP header and black and whitelisting for selective blocking of trackers. The family of documents in this working group include Tracking Preference Expression, often referred to with the acronym DNT named after the original Do Not Track proposal (Fielding and Singer, 2019), and Tracking Compliance and Scope (TCS) (Doty et al., 2019) and aim to enable the users to signal their preference for not being tracked by third parties as part of each HTTP request that is sent from their browser, and define compliance practices for web servers when they receive a DNT signal from a Web user.[7]

Do Not Track is a blanket term that refers to both technologies and policies (Mayer and Mitchell, 2012), and W3C DNT stemmed from the intersection of policy and technology (W3C, 2011). However, compliance to W3C DNT has so far been optional and the standard does not set enforceable actions upon receiving a DNT signal. For example, when the Do Not Track request is received, one OBTA firm might delete all existing cookies and set no new cookies, whilst another OBTA firm may replace user's unique identifier with an 'opt-out' string, and other trackers might continue collection but slightly change the usage ((MDN), 2013). As a result, as of today, W3C DNT does not need to be respected, and individuals would not know whether it is being respected or not prior to sending an HTTP request. Furthermore, W3C DNT does not provide provisions for communicating what has been passed amongst OBTA actors in the back end.[8] Balebako et al. (2012) found that 'the preferences of DNT users are currently being disregarded.' As of 2015, case studies presented by ((MDN), 2013) demonstrated how OBTA firms that comply with Do Not Track (DNT) may have different interpretations of tracking, first party, third party, and DNT. A bigger issue is that consumers would not know how these terms are being interpreted in action.

In addition to standard setting bodies, there have been initiatives from self-regulatory groups within the OBTA industry to address some of the concerns surrounding OBTA. However, in many cases they lack of enforcement/redress mechanisms, or come with usability flaws that make them not affordable or practical for web users. In what follows I will detail some of these initiatives. In the United States, in response to privacy concerns groups such as Network Advertising Initiative (NAI) and Digital Advertising Alliance (DAA) were formed (Federal Trade Commission, 2000). The major initiative from these groups is the cookie optout initiative where users' choice to optout is stored on a cookie and is sent back in each request. NAI (NAI, 2000) and Your ad choices

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[7]The history of Do Not Track goes back to a public interest proposal to FTC by a group of US based privacy advocacy organisations (Schwartz et al., 2007), its consequent mechanism as introduced by FTC (2010) leading to Microsoft's Tracking Protection List and Mozilla's header-based implementation, and consequently, its original draft of by Mayer et al. (2011) in IETF.

[8]The Tracking Status Object may contain several properties that enable the web server to communicate some of their operational details (config, policy, audit, etc.), but as of 2015 it did not provide provisions for communicating any sharing, or consolidations that may have occurred in the back end (W3C, 2011).

(EDAA, 2009) provide websites where consumers can set their preference for opt out of targeted advertising by OBTA entities that have agreed to comply with this opt out mechanisms.

There have been a number of studies demonstrating limitations of these initiatives. For example, Balebako et al. (2012) suggest that DAA and NAI opt out mechanisms do not guarantee that 'their members' optout cookies will limit data collection or tracking, only that they will prevent the consumer from seeing behaviorally targeted ads from member agencies.' Furthermore, Komanduri et al. (2012) found many instances of noncompliance to self-regulatory principles by members of the selfregulatory groups. Additionally, a study by McDonald and Cranor (2010) on NAI's initiative concluded that opt-out cookies do not meet users expectations, and only 11 percent of their sample users understood the 'text description of NAI opt-out cookies.' Similarly, Leon et al. (2012) found that DAA opt out's confusing interface and usability flaws led to unintended actions from users. They also suggested that EDAA (2009)'s opt-out mechanism has a challenging and time-consuming process for many users (Leon et al., 2012). Additionally, it was suggested that upon receiving the request, it is possible that NAI members continued tracking users (Mayer, 2011b). Furthermore, some of the members of the NAI initiative interpret consumers opt out request by only stopping targeted advertising, and do not stop tracking. Finally, cookie opt-out was diagnosed with a design flaw: many privacy concerned users keep deleting their cookies, which also results in the deletion of the opt-out cookie. In response to this design flaw, in 2009, Google released a plugin that allowed users to delete their cookies without deleting the Google optout cookie. Building upon this, a plug-in called TACO was developed that extended Google's plug-in to include other opt-out cookies (Soghoian, 2009). TACO Chrome plug-in aimed to fix the design flaw inherent in NIA's opt-out mechanism by preserving the opt-out cookie in the users browser whilst discarding other cookies upon emptying the cache. However, the usability of TACO also appears to be challenging. Leon et al. (2012)'s study suggested that 'Participants testing TACO never realized that they were not blocking any trackers.'

Aside from the initiatives led by selfregulatory groups some companies themselves have implemented tools and settings for providing explanation of the collection, flow and usage of data or explanation of the targeting practices to consumers. For example, various key OBTA companies have started initiatives that provide a degree of control over what ads might be chosen to be received by a consumer allow stating their ad preferences and provide explanation on why a consumer is seeing an ad (Google, d; Facebook, b,a). However, the degree of the provided details about the operations, usage, and profiles provided in some cases are often insufficient. This raises questions about the degree by which information about the generated profiles are disclosed (Datta et al., 2015, pp.92).

Other interventions surrounding OBTA include monitoring and blocking tools. The former monitor the interactions with the browser, and the latter block tracking or targeted ads (EFF, 2018; ABP, 2004; Toubiana et al., 2011; Ghostery, 2009; Fowler, 2013).

Monitoring online tracking and advertising of OBTA companies has also been subject to research in th epast decade. A wide range of empirical and theoretical research from academic and journalistic sources have made the issues surrounding OBTA visible (Angwin, 2010; Acar et al., 2014; Soltani et al., 2010; Mayer and Mitchell, 2012; Leon et al., 2012; Mikians et al., 2012).

Although it is likely that third party tracking remains invisible for the web users, parts of it are discoverable and observable through monitoring the browser traffic. This is because often the tracker is embedded within the first party web page. Examples of trackers include social media widgets or invisible pixels commonly known as web bugs. In some cases where data such as cookies and ids are shared and synced between different actors to inform each other about a user's visit to a particular website, monitoring such interactions between actors are more challenging as there are no observable traces of this interactions left on the browsers. Such interactions are often with the aim of targeting advertising to the user/visitor that is perceived relevant to their inferred demo/psychographics. Despite these challenges, there have been studies on making causal inferences about the data sharing relationships between actors (Bashir et al., 2016). However, still making first party tracking and the data processing afterwards such as sharing with third parties visible remains challenging in the absence of requirements for disclosure. Regardless of the gaps, there have been a body of research facilitated by tools and technologies for reverse engineering and monitoring data collection, flow and usage in OBTA (Diakopoulos, 2015; Eubank et al., 2014). Some of these studies involved developing tools, technologies, and methodologies that have been re-used in various studies and research collaborations. Examples include Fourthparty (Fourthparty), and Open WPM (Englehardt and Narayanan, 2016). These monitoring tools and methods have made a key contribution to understanding the technical operations of OBTA, identifying problematic practices, and informing policy and public debate.

Another group of tools and technologies that were developed in response to concerns surrounding OBTA are blocking and obfuscation tools. Blocking tools can be mainly categorized as self-help tools for consumers. Many blocking tools operate based on refusing cookies and/or scripts from domains from a blacklist (Balebako et al., 2012),[9] whilst others such as NoScript use whitelisting. Some of the blocking initiatives have been controversial due to lack of transparency in their whitelisting processes (Walls et al., 2015). Some ad blockers do not stop tracking and only prevent targeting and displaying of the ads, and others stop tracking in which case are often referred to as tracking blockers.

However, as detailed in the previous section not all OBTA are problematic, or raise concerns, and treating all ads in the same way lacks nuance. Additionally, whilst it cannot be generalised, some of the tools that limit tracking and advertising, and enable monitoring aimed for enhancing individual control come with usability limitations. For

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[9]It should be noted that as Bashir et al. (2016) point out blocking third party cookies does not stop first party trackers.e.g. Facebook.

example, a study by Leon et al. (2012) in 2011 details capabilities of nine tools for limiting OBTA including self-help tools such as Ad block plus and Ghostry, some of the browser vendors privacy settings and tracking protection. They found serious usability flaws with all nine. For example, in relation to Ghostery (2009) they found that participants were unaware that the default settings do not block trackers (Leon et al., 2012, pp. 10), whilst in relation to AdBlock Plus 'participants did not understand AdBlock Plus' filtering rules' (Leon et al., 2012, pp. 20). Others also highlight that some of the whitelisting practices leave users 'vulnerable to unscrupulous ad network,'[10] and lack transparency about their whitelisting processes (Walls et al., 2015), whilst other whitelisting tools such as NoScript are too complicated, or cause inconvenience for the users (Bashir et al., 2016).

Another approach to bringing FIPPs back to the realm of OBTA is 'privacy by design' (Cavoukian, 2010). Privacy by design, emphasises that technologies are by defalut designed and developed with privacy considerations (Cavoukian, 2010). This has inspired research in the OBTA domain. Various studies have explored privacy friendly OBTA (Toubiana et al., 2010; Fredrikson and Livshits, 2011; Backes et al., 2012). For example, Adnostic Toubiana et al. (2010) and Privad (Guha et al., 2009) are privacy preserving advertising methods for browsers. In both cases, ads are downloaded and are shown when relevant without leaking users information. However, it is suggested that privacy friendly ad exchanges are not yet widely adopted (Fredrikson and Livshits, 2011; Guha et al., 2011; Bashir et al., 2016; Backes et al., 2012).[11]

As demonstrated in this section traces of FIPPs can be followed across many legal and technological interventions, self-regulatory initiatives, and Web standards. In the following section I will focus on a derivative model from FIPPs, often known as the notice and choice model as it is often the underlying logic behind many of the interventions that were described in the section. I explore some of the key benefits and limitations of this model.

5.2   Notice and choice/consent model

One of the major models derived from FIPPs is the model of 'notice and choice' or the 'notice and consent model.' Many of the interventions mentioned in the previous section are underpinned with the logic of notice and choice. The regime of notice and choice derived from FIPPs has significantly influenced the EU and US privacy law and data protection legislation. For example, the proposed draft of ePR requires confidentiality of information and consent of all parties involved (Commission et al., 2017). The GDPR is

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[10](Bashir et al., 2016, 494) draw on (Walls et al., 2015) to state: ' AdBlockPlus's controversial "Acceptable Ads "program is poorly governed and leaves users vulnerable to unscrupulous ad network.'

[11]Some of these works build on previous research in the wider domain of privacy preserving data mining and data analysis that has been ongoing for more than a decade (Dinur and Nissim, 2003; Dwork and Nissim, 2004; Kasiviswanathan et al., 2011).

not limited to the notice and choice model as it contains other principles such as purpose limitation (EU General Data Protection Regulation, 2016). Processing personal data for behavioural advertising in the EU requires consent (Party, 2013, pp.46), in addition to other safeguards (47).

Historically, the over-reliance on notice and choice in the absence of other components of FIPPs in the US, has been often criticised for leaving gaps in pursuing the aim of FIPPs.[12] In the past decade, the tendency for over-reliance on the model of notice and choice in the absence of other obligations and safeguards has been criticised across academic research and popular media (Solove, 2013; McDonald and Cranor, 2008; Barocas and Nissenbaum, 2009; Ben-Shahar and Schneider, 2010; Solove, 2013; FTC, 2012; Edwards, 2018). Concerns for many are due to a tendency in employing this model as an individualized form of data protection, and as an 'end' as opposed to 'a means for an end' (Barocas and Nissenbaum, 2009). However, a sociotechnical phenomena known as 'privacy paradox' is used by some to indicate the limiting affordances of the notice and choice model and existing privacy framework. I will detail this argument in the following paragraphs.

The idea of having conflicting willingness for maintaining privacy and sharing data at the same time,[13] known as 'privacy paradox' (Barnes, 2006) appears to be first mentioned in 2000 in an article in InformationWeek 'Privacy Paradox: Consumers Want Control — and Coupons' (Singer, 2015). An example of privacy paradox is often demonstrated in an online survey by Renfrow (2015), where the majority of shoppers were found to be willing to receive promotional offers in return for data tracking practices, despite only a small percentage stating to be prepared to expose their location or browsing history with their retailers. More specifically, 60% of shoppers stated that they would like to receive real time promotions which might require data collection, whereas only 20 percent of them are prepared to expose their location to their retailers and only 14% would be willing to share their browsing history.

There are competing narratives seeking to explain 'privacy paradox.' On the one hand OBTA firms often suggest that consumers are willing to share their information in exchange for personalised ads (Yahoo!, 2014). Others suggest that consumers often exchange their data without fully understanding the terms of the trade (Singer, 2015; Turow et al., 2015), and not fully being aware of the of risk and danger (Acquisti and Gross, 2006; Tufekci, 2008), lack of skills (Park, 2013), consumers resignation over giving

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[12] Gellman (2017) observes an example of this acknowledged in an early draft of the US Federal Trade Commission (FTC) staff report in 2010. This report suggested that .'..the emphasis on notice and choice alone has not sufficiently accounted for other widely recognized fair information practices, such as access, collection limitation, purpose specification, and assuring data quality and integrity' (FTC, 2010, pp. 20). However, as Gellman (2017) observes, this text is not included in the final draft that was published in 2012 FTC (2012).

[13] For example, a poll by Madden and Rainie (2015, pp.5) suggests that participants state to demand privacy and control over their information.

up their data (Hargittai and Marwick, 2016), or thinking that data collection is inevitable (Turow et al., 2015), as a result of which consumers might not afford to make conscious and/or rationale decisions about the trade-offs. For instance, studies found that many do not read privacy policies (McDonald and Cranor, 2008; McRobb and Rogerson, 2004; Turow et al., 2009; Gomez et al., 2009; Bartsch and Dienlin, 2016), and come with high costs of reading and insufficiently granular (e.g. request, browser or user specific), making pragmatic trade off choices costly and impractical for many citizens (McDonald and Cranor, 2008). It is also suggested that consumers value their privacy much more than what the OBTA industry perceives as value (Castelluccia et al., 2014), and that, opting out might not be realistic or practical (Barocas and Nissenbaum, 2009). As a result, all of this challenges the claims about conscious trade-off as explanation of 'privacy paradox.' Also, the notice and choice model comes with different affordances for different social groups. For example, low income groups are less likely to have or employ privacy skills online, and are more dependent on mobile phones for online access which makes them more exposed to tracking (Madden et al., 2017).

Meanwhile, often the critiques of the notice and choice model concerned with data protection do not dispute its necessity, rather they emphasize the fact that it is merely not enough. Some have warned that the critique of the notice and choice model might have created a misconception that restricting information collection is not achievable, making data collection inevitable (Nissenbaum, 2017, pp.1). This suggestion has been followed by controversial debates (Nissenbaum, 2017; Couldry and Yu, 2018). As a result, some warn against 'extreme skepticism' of the notice and choice model, arguing that not all of the available notice strategies are not yet explored and deliberated (Calo, 2012, pp. 1030). For example, ongoing work on exploring nudging as a policy intervention to encourage consumer behaviour that protect their privacy online (Acquisti, 2009; Wang et al., 2014), or 'just in time' notice. As a result, the core criticism on the notice and choice model is that it is necessary but not enough. Over-reliance on personal control and management of privacy, and the underlying expectation from individuals to manage and control difficult processes (McStay, 2017) is often considered unrealistic and is criticized for not being able to 'accurately map to human behavior' (Marwick and boyd, 2014, pp. 1063).

All of this, has made some highlight the shortcomings of over-relying on the notice and choice model, and suggesting alternative approaches (Edwards and Veale, 2018). For example, Edwards et al. (2016, pp.2-3) suggests to instead look for an 'environmental' approach that discourages or eliminates problematic practices (Edwards et al., 2016, pp. 2-3).

5.3 Beyond notice and choice

This section concludes from the history of previous interventions, that transparency has been used with different definitions, scopes, and motivations. Drawing on others, this section argues that transparency can be a red-herring if used as a replacement for safeguards and obligations for ensuring data are not collected and used in ways that are detrimental to individuals and groups and re-produce existing social issues such as inequalities. As a result, transparency in this thesis is considered as a type of operational transparency that enables empirical research to inform public and policy debates, including governance and regulation research.

As demonstrated in the history of interventions, mechanisms for transparency have been limited in OBTA technologies and practices. Sometimes the notice model is used interchangeably with transparency. However, it is argued that notice and transparency are not synonymous, as openness, the first principle of fair information practices is not met through notice (Bruening and Culnan, 2016, pp.4). Bruening and Culnan (2016, pp.4) argue that notice can be limited to communication of privacy policies, whereas openness, can refer to

> 'a condition of disclosure and openness jointly created by companies and policy makers through the use of a variety of approaches, notice being among them.'

They therefore suggest notice and transparency are not the same, calling for a more comprehensive model of transparency (Bruening and Culnan, 2016, pp.4).

Additionally, as illustrated in Chapter 4, concerns surrounding to OBTA are not limited to privacy harms, and include concerns over re-enforcing existing social issues such as inequalities on scale. In such cases, proposals such as Zittrain (2014); Balkin (2016)'s fiduciary obligations offer more potential than narrow focus on notice and choice, although are yet to be implemented. Moreover, other approaches to safeguard or eliminate problematic practices in domain specific sectors have been discussed. For example, Zuiderveen Borgesius et al. (2018) explore the role of OBTA technologies and practices in political micro-targeting, potential over-arching regulations, and the implications and costs of this that requires public debate.[14] They emphasise amongst others, as discussed in Chapter 4, that a pre-requisite for all of these is more empirical research on the operations of OBTA that is currently challenging. As a result, in this thesis, the notion of transparency is used to refer to a type of operational transparency that can enable research in a way that can enable governance, to inform public and policy debates, differentiated from other types of transparency that are limited to a notice and choice model.

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[14]For example see boyd (2018b).

This section provided an overview of the academic and journalistic research that focused on empirical exploration of OBTA for example, using reverse-engineering techniques or monitoring tools. It was suggested that these studies have impacted public and policy debates and in some cases have led to policy interventions. However, as discussed in chapter 4, there is still a need for more empirical research not only to understand the inner workings of OBTA, but also to develop a sociotechnical understanding of their heterogeneous actors as they relate to OBTA actors and web users in the wider context. For example, there is a need to better understand how existing safe-guards may be circumvented in indirect, implicit and/or accidental ways (Citron and Pasquale, 2014) that requires further empirical research. It could therefore be argued that this operational transparency, should include not only the analytic operations of OBTA, but also the administrative side to enable research. This raises a new question: ***How can transparency in analytic and administrative operations of OBTA be enhanced in a way that can enable research?***

In the wider domain, many have highlighted that transparency should be 'meaningful' and 'qualified' (Selbst and Powles, 2017; Diakopoulos and Koliska, 2017; Brauneis and Goodman, 2018), and have warned that transparency is not enough on its own, and once the impact of the operations are understood, achieving accountability requires wider sociotechnical and legal considerations (Kroll et al., 2017; Ananny and Crawford, 2018; Burrell, 2016). Meanwhile, having transparency over the interplay of OBTA technical processes and social practices is a small but necessary step for investigating where existing technological and governance safe-guards fall short, and researching and deliberating appropriate ways of addressing the concerns. Additionally, as argued in the previous chapter, this can be beneficial for re-building trust when OBTA are not problematic.

Similar arguments have been made in the wider domains from the criminal justice system, to healthcare, and eduction. A growing body of research explore algorithmic transparency, accountability and fairness (FATML, 2014; FAT Conference, 2018; Caplan et al., 2018; AINow, 2018; Lab, Lab; Society, Society)., and exploring the on-going debates can help exploring answers to the question posed above. The following section introduces some of key themes (as of 2018) in this body of research.

5.4   Algorithmic transparency

Various scholars across disciplines have called for algorithmic transparency (FTC, 2014; Sandvig et al., 2014; Pasquale, 2015), accountability (Diakopoulos, 2014, 2015; Ananny and Crawford, 2018; Pasquale, 2015; Caplan et al., 2018; Kroll et al., 2017; Pasquale, 2015; Burrell, 2016). and procedural due process (Citron, 2008; Crawford and Schultz, 2014; Citron and Pasquale, 2014).

From the industry's perspective, transparency has benefits as clear communication of OBTA operational details can positively affect consumer trust(Tene and Polonetsky, 2012; Ur et al., 2012; FTC, 2013; Eslami et al., 2018). For example, in the case of recommender algorithms providing operational details to consumers, has shown to increase consumer trust in recommender systems (Pu and Chen, 2007; Wang and Benbasat, 2007).

However, pursuing an appropriate form of transparency that could enable sociotechnical research is very challenging. For example, an approach would be to provide access to the source code. However, seeing the algorithms is not the same as understanding them (Seaver, 2013; Ananny and Crawford, 2018), and sometimes, transparency can itself conceal crucial information (Strathern, 2000). Also, transparency might also, mistakenly or wrongfully, convey a false feeling of accountability. Pasquale (2015) brings the example of a firm, whose response to an information request is in the form of 30 million pages, making it difficult to find a needle in a hay stack. Another reason why the type of transparency that comes with a generic approach such as releasing the source code might not be helpful for investigating concerns is that as discussed in chapter 4, OBTA algorithms are not the only source of concern on their own. Sometimes concerns are surrounding the data, and sometimes concerns are simply about when and where OBTA are used. Also, having access to the source code might not enable determining if, where, and when discrimination might have occurred, or enable making a case for action, as in many cases, issues such as exclusion and discrimination are faced by specific social groups, for example, those that have historically been subject to inequalities, hence the data inheriting the social and cultural biases. Moreover, on the one hand, it is also possible that complexity and the proprietary nature of decision making algorithms is used as a justification for refusing data subject inquiries, but on the other hand, in some cases, there might be legitimate reasons for not providing transparency (i.e.real and legal secrecy) (Pasquale, 2015). To avoid issues in cases of legitimate secrecy, it is suggested that operational details do not need to be transparent to all, but just to the relevant actors (Pasquale, 2010). This argument could be extended: operational details could be made accessible to enable research, be it for governance and regulatory research, or for sociotechnical academic and journalistic research to explore when and where issues can rise and how they can be avoided. Meanwhile, a key consideration here, is that transparency is not a solution (Kroll et al., 2017; Ananny and Crawford, 2018; Burrell, 2016). But enabling empirical research can inform public and policy debate and help thinking about how the concerns and questions can be answered.

Meanwhile, as showed in the previous section, transparency has been framed in technology and legal debates mainly by individual rights to receive explanation about the collection and processing of their data, or providing transparency to Data Protection Authorities (DPA)s upon request. These framings come with different affordances that vary across different countries. The challenges in the EU are not so much about transparency requirements, but more at the level of affordances for individuals and groups in

exercising them.

For example, there are rights in the EU that support access to the data collected (i.e. data subject access rights), exercising these rights can be challenging. Ausloos and Dewitte (2018, pp.4) conducted a legal empirical study where they contacted 60 service providers with subject access request rights and 'confirmed the general suspicion that access rights are by and large not adequately accommodated.' Meanwhile, the challenges in the US are more at the level lack of transparency requirements and lack of incentives for businesses to adopt such provisions. For example, subject access request rights are less supported in the US (Angwin, 2014), and amongst those who allow access, some provide partial view (Singer, 2012). Meanwhile discussions and debates on requirements for algorithmic transparency across EU and US are ongoing.

Additionally, as part of its provisions, the GDPR maintains requirements for automated decision making from the 1995 Data Protection Directive that it replaces, and has provisions for rights is in relation to automated decision making that is of relevance to detecting bias in profiling and algorithmic decision making. For example, Goodman and Flaxman (2017) interpret section 2 of the GDPR as a 'right to explanation.' Others argue that this section only secures an ex ante description of what the system is about to do, as opposed to an ex post information about the decisions made about an individual in a way that corresponds to their circumstances (Wachter et al., 2017). Meanwhile, this was followed by suggestions that whilst a 'right to explanation' is not present in the text of GDPR under such term, yet such a right is not illusory (Selbst and Powles, 2017).

However, it is argued that the on-going debates on 'right to explanation' might run the risk of obscuring other aspects of GDPR. For example, Kaminski (2018, pp.193) argues that there is a potential in GDPR's new accountability regime, and the guidelines provided by the Working Party/Data Protection Board can be reflexively mobilised for enhancing transparency and accountability in algorithmic decision making. Additionally, Kaminski (2018, pp.217) argues that the GDPR

> 'sets up a system of "qualified transparency" over algorithmic decision-making that gives individuals one kind of information, and experts and regulators another'

. Meanwhile, the guidelines of the working party suggest that sections of the GDPR that focus on algorithmic decision making such as 'individual decision making, including profiling' (EU General Data Protection Regulation, 2016, supra note 6, at art.22.), can be applied to some behavioural advertising [pp.202].

These potentials have inspired the technical community to explore approaches to support and facilitate algorithmic transparency, accountability, and fairness. This includes exploring approaches for auditing the inputs and outputs of algorithms for discovering discrimination issues (Hajian and Domingo-Ferrer, 2013, pp. 1445), and identifying

fairness violations (Dwork et al., 2012). Since then, various technical approaches, frameworks and implementation of algorithmic transparency have been proposed. Currently there is an on-going debate about how transparency could and should look like (Burrell, 2016; Desai and Kroll, 2017; Kroll, 2018; Selbst and Barocas, 2018). Some of the ongoing technical work in this area and their strengths, challenges and limitations are described in what follows.

Approaches to algorithmic transparency have been wide ranging across different stakeholder groups and in different domain sectors. Today, there is a growing body of research within the technical community in the wider domain of algorithmic decision making and machine learning. Defining transparency and opacity constitutes a key part of this. For example, transparency in machine learning can be categorized in three different levels: 'entire model (simulatability),' 'individual components (e.g. parameters) (decomposability),' and 'at the level of the training algorithm (algorithmic transparency)' (Lipton, 2018). However, explaining models can be challenging as the logic of the model can change during the processes of training data (Burrell, 2016). Therefore technical work has focused on both an ex ante explanation and an ex post explanation.

There is also ongoing research on defining interpretability (Lipton, 2018; Doshi-Velez and Kim, 2017). It is suggested that sometimes there is a trade-off between accuracy and intelligibility in machine learning (Caruana et al., 2015). One proposed way to investigate complex models has therefore been to use transparent models to audit black-box models (Tan et al., 2018). However, in practice, models might sometimes not be 'complex enough' and only a small number of variables might end up being used (Caruana and Research, 2018). Another approach is where possible, to identify the relationship between inputs and outputs (Kroll et al., 2017), and recreate a map of part or all of the model (Selbst, 2017). This particularly applies when opacity is due to IP and the propitiatory nature of the models as opposed to complexity.

Meanwhile, there are approaches towards overcoming the challenges caused by trade-offs between accuracy and intelligibility. This includes approaches for self-explaining machine learning. For example, LIME is an algorithm that uses adaptive learning techniques to explain the predictions of any classifier in a locally faithful way, by calculating how close it is to an interpretable model (Ribeiro et al., 2016).

However, in many cases, implementing algorithmic transparency faces challenges that are not constrained within the technical realm and have their roots in complex social phenomena. For example, as noted in the beginning of this section, transparency itself might conceal important social, cultural and organizational information (Strathern, 2000, pp. 310). In many cases, simply seeing the data model is not helpful as it does not mean understanding them (Ananny and Crawford, 2018), and providing meaningful algorithmic transparency is very challenging (Seaver, 2013; Ananny and Crawford, 2018; Eslami et al., 2018). Moreover, remedies based on transparency, and the audit culture

are often critiqued for their technocratic lenses, that can oversimplify the complexities of the social world (Seaver, 2013).

It is also argued that 'inscrutability' and 'nonintuitiveness', two distinct characteristics of the machine learning models, might have been conflated in the calls for explanation and their responses (Selbst and Barocas, 2018). Selbst and Barocas (2018, pp.1085) note:

> 'Dealing with inscrutability requires providing a sensible description of the rules; addressing nonintuitiveness requires providing a satisfying explanation for why the rules are what they are'.

It can therefore, be argued that it is possible that so far, many of the responses to calls for explanation have been focusing on explaining the rules that are applied by the models, without describing the underlying ontological, epistemological and methodological assumptions based on which the rules are derived from the data. This is whilst explanation and transparency should be in such way that enables questioning the underlying assumptions behind the rules, and how they can be used for governance. More specifically, Selbst and Barocas (2018, pp.8) note that there is a need to bridge the disconnect between explaining and being able to judge the ethical and legal basis of the decision-making. They suggest that '...we need to require process, documentation, and access to that documentation (Selbst and Barocas, 2018, pp.54).'

All of this illustrates the challenges for enhancing transparency in a way that can enable research in the wider domain of algorithmic decision making. Meanwhile, the theoretical approach adopted in chapter 2 means that this thesis needs to go beyond the critique, look for alliances , and experiment with partial solutions. This means acknowledging the critiques and challenges of transparency and being reflexive about the limitations, whilst engaging across disciplines to explore how the current state of transparency in OBTA can be improved.

In the context of OBTA, it could be argued that the above challenges could be largely reduced if analytic and administrative operational details of OBTA were documented in the first place and communicated as part of the life cycle of a targeted ad. For example, if the input variables of a machine learning algorithm used for targeting ads, the sources of data for the inputs variables, and the segment that the ad is categorised as are all documented and communicated, some of the current challenges on the way of researching OBTA can be addressed. Therefore, in exploring for what transparency in OBTA could look like, it could be argued that systematic documentation and communication of the processes in the pipeline of the targeted advertising in a way that can be used for governance can offer a promising approach.

5.5 Conclusion

Chapter 4 suggested that concerns surrounding OBTA include concerns over misuse, and exploitation of OBTA technologies and practices. However, concerns are not limited to problematic practices, and can raise from the contingencies from the interplay of social and technical in OBTA. Also, investigating the interplay of OBTA technologies and practices is crucial, due to the ephemeral and tailored nature of targeted ads that can only make them visible to those that they are targeted to. Moreover, not all OBTA raise concerns. However, there has been a decline of trust in OBTA that if not addressed, can have repercussions for Web businesses. It was argued that therefore, operational transparency that can enable research can contribute to trust-building by OBTA industry. Moreover, it was argued that researchers have been calling for more empirical research on not only tracking and sharing mechanisms but also on ad-targeting mechanisms to better understand OBTA. As a result, it was argued that there is a need for operational transparency in OBTA that can enable research. However, OBTA operations are often opaque.

This chapter aimed to learn from the history of previous interventions, what a mechanism for enhancing transparency in OBTA might look like. It was suggested that transparency can be a red-herring when used as a replacement for obligations and safeguards, but on the other hand, mechanisms for transparency and accountability are needed - in addition to safeguards, obligations and other measures,[15] for enabling research including governance and regulation research (Balkin, 2017). Therefore, transparency over OBTA is a small but necessary step. The first section of this chapter, exemplified studies that used reverse-engineering techniques to monitor OBTA activities on the Web. It was suggested that in addition to such methods, there is a need for researching both administrative and analytic aspects of OBTA operations in a way that provides a wide picture on the organisational dynamics of OBTA, investigate how OBTA assemblages relate to each other in the wider context, and enable sociotechnical research.

In the past decade there have been widespread calls for transparency across disciplines and domains. However, devising transparency that can support accountability is very challenging. Technologists sometimes find the demands detached from the technical affordances, and social scientists often find technology unable to account for the complexities of the social concerns at hand. As a result, in many cases, the efforts to address the critique translates either into technical solutions (e.g. self- explicable algorithms), or broad public policy requirements/recommendations (e.g. releasing the source code). These two sides of the spectrum both come with challenges. For example, opening the source code can be impractical and problematic: There might be legitimate cases of secrecy (Pasquale, 2015), and seeing the source code does not equal knowing what it

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[15]Such as fiduciary obligations (Balkin, 2016) (For details see footnote 5.1), and data due process (Crawford and Schultz, 2014).

means (Seaver, 2013; Ananny and Crawford, 2018), and it can also obscure some of the important and crucial details (Strathern, 2000). Also, focusing on the machine explanations is not enough for understanding what they mean for governance and what were the underlying epistemological, ontological and methodological assumptions (Selbst and Barocas, 2018). This has left a gap between calls for transparency and their responses.

The theoretical approach adopted in this thesis, enables acknowledging the critiques of transparency, yet moving beyond the critique to experiment with ways of opening up a space for enhancing the current state of transparency in OBTA to enable research.

In addition to on-going research on reverse-engineering OBTA or devising technical mechanisms for algorithmic transparency, one way towards reducing the above challenges, would be to mobilise sociotechnical agency for enhancing transparency in OBTA: to document and communicate the operational by OBTA companies. As a result, this thesis proposes an approach for filling the gap through systematic documentation and communication of the administrative and analytic details in a way that can be used for governance. This raises the question **how can the operational details behind the analytic and administrative processes of OBTA be documented and communicated in an interoperable way across different actor groups in a way that can enable research?** The following chapter, explores a methodology for exploring answers to this question.

Chapter 6

Designing a sociotechnical intervention

The previous chapter investigated what a mechanism for enhancing transparency in OBTA and the wider domain might look like. It was argued that so far, these mechanisms have mainly been either technical, framed by reverse-engineering or mechanisms for algorithmic transparency, or in the form of broad policy recommendations such as opening the source code, hence leaving a gap. Inspired by the theoretical approach adopted in Chapter 2 it was argued that one approach for filling this gap is mobilising sociotechnical agency, and proposed documenting and communicating the analytic and administrative operational details by OBTA companies to enable research. As a result, the chapter ended by asking ***How can the operational details behind the analytic and administrative processes of OBTA be documented and communicated in an interoperable way across different actor groups?***

Inspired by the theoretical approach adopted in chapter 2, this chapter blends ideas and methods from different disciplines under the interdisciplinary umbrella of Web Science to design a methodology to look for answers to this question. More broadly, the chapter outlines how a sociotechnical intervention for enhancing transparency in OBTA can be envisaged in a way that enables engaging with stakeholders and exploring the capacities for enhancing operational transparency in the OBTA ecosystem. The design of this intervention is framed in such a way that pursues the main aim of this thesis which is to develop a sociotechnical understanding of OBTA.

6.1   Designing the research and theoretical inspirations

Inspired by the theoretical approach adopted in Chapter 2 particularly the works of Donna Haraway, and drawing on the review of previous interventions surrounding OBTA,

Chapter 5 argued that designing an intervention that can support operational transparency, requires a sociotechnical approach that engages with different disciplines and actor groupss. This means experimenting with capacity-building, and embracing partial solutions. In addition to this, theories of speculative design and sociotechnical imaginaries inspire this chapter in designing its research, and are described in what follows.

Drawing on the works of Dunne and Raby (2013); Bardzell and Bardzell (2013) and Lupton (2018), *speculative design* in this thesis is considered as a type of design that as described by Lupton (2018, pp.5) enables experimenting with 'problematising futures and opening up possibilities for preferable futures.'

Drawing on the works of Jasanoff and Kim (2015), *sociotechnical imaginaries* can be described as

> 'collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology.' (Jasanoff, 2015, pp.6)

The above concepts are used to frame the research in the following way.

1. **Speculative design of a model for enhancing operational transparency in OBTA** using academic and grey literature described in section 6.2.1.1.

    (a) Conceptualising a model for documenting and communicating the analytic and administrative operational details behind a targeted in an interoperable way across different actor groups.

2. **Analysing speculations about the affordances of [1] for its imagined users and uses** using semi-structured key informant interviews described in section 6.2.2.

    (a) Exploring if and how [1] can be imagined to be used? If so, by whom? and how? and what are its promises and challenges?

    (b) Exploring sociotechnical imaginaries in [2a] to explore incentives for transparency and exploring the current dynamics of OBTA ecosystem.

Before outlining the methodology for conducting the outlined research, a brief overview of the above concepts are provided in what follows to contextualise them in the wider domain.

6.1.1 Speculative Design

In looking for answers to the question asked in the beginning of this chapter, this thesis applies the framework of speculative design to conceptualise a model for systematic

documentation and communication of OBTA operational details. Speculative design is a form of critical design (Malpass, 2013) and can be described as a 'catalyst for social dreaming' (Dunne and Raby, 2013, pp.189). The following paragraphs expand on critical design before specifically focusing on speculative design.

Critical design brings social and political theory into the design process to ask provocative questions and challenge conventional assumptions (Dunne and Raby, 2013). Bardzell and Bardzell (2013) re-conceptualise critical design to makes it more practical and easier to adopt by HCI researchers that are concerned with critical design, particularly in the emerging field of 'research through design or constructive design.'[1] The aim of this re-concpetualisation is to go beyond a narrow scope of 'critical' in Dunne and Raby (2013)'s conceptualisation,[2] to provide an accessible methodological direction for bringing about more critical attitudes and critically innovative thinking among designers (Bardzell and Bardzell, 2013, pp.3298) in a way that can help drive positive social change (pp.3301). As a result, Bardzell and Bardzell (2013) understand critical design as

> ' a research through design methodology that foregrounds the ethics of design practice, reveals potentially hidden agendas and values, and explores alternative design values.' (Bardzell and Bardzell, 2013, pp.3297)

Speculative design has been discussed in relation to its potential for the emerging filed of 'design sociology' Lupton (2018, pp.5). Lupton (2018, pp.5) describes speculative design as a type of design that is not directly concerned with problem solving, but rather, enables experimenting with 'problematising futures and opening up possibilities for preferable futures.' For example, speculative design can draw on 'satire, exaggeration and allegory (Malpass, 2013),' that when combined with participatory design approaches, can be used to provoke participants 'into thinking differently and creatively, perhaps raising questions about conventions and assumptions' (Lupton, 2018, pp.5). Lupton (2018, pp.5-6) draws attention to example the application of speculative in a research concerned with self-tracking: Gross et al. (2017) created arefacts that were intentionally designed to be controversial due to their intrusive qualities. They then explored how participants engaged with the devices and exercised agency over them (Gross et al., 2017, pp.331). This enabled them to challenge some of the common assumptions about self-tracking and opening up new ways of thinking about how the devices can be used in the future (Lupton, 2018, pp.5-6).

In this thesis, speculative is used to frame the conceptualisation of a model for documenting and communicating operational details by OBTA actors to enable research. Such

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[1] For this, they draw on Koskinen (2011, pp.5) who define this as 'design research in which construction–be it product, system, space, or media— takes center place and becomes the key means in constructing knowledge.'

[2] For example, Bardzell and Bardzell (2013) dispute Dunne and Raby (2013)'s binary positioning of affirmative vs critical design and their claim that critical design is not art (Bardzell and Bardzell, 2013, pp.3304).

model would be controversial due to the divergent interests in the OBTA ecosystem that makes OBTA actors to have different views about transparency in OBTA. Instead of embarking on developing such artefact, the model is turned into a speculative proposal that enables engaging with key informants and provoke discussions surrounding operational transparency in OBTA. In this sense, the speculative design aims to intervene in the current thinking about transparency in OBTA by provoking to think differently about the future of OBTA and the Web.

The speculative framing can be beneficial on multiple levels.

- It can help prioritise investigation of the core idea behind the proposed approach for documenting and communicating operational details to technical concerns about development and implementation.

- It can facilitate knowledge elicitation and adjusting the imagined users/uses of the model before having embarked on development.

- Since the implications of TATE are not known, the speculative framing can enable safe exploration without the risk of causing privacy or security issues for individuals or groups and/or businesses. This could help identify the risks, challenges, and short-comings, capacities, promises, and strengths of the proposed approach as well as common assumptions about transparency in OBTA.

- The proposed level of transparency for its current imagined user/uses could be controversial amongst different actor groups and can provoke valuable discussions with key informants in the second part of the research.

As a result, the speculative framing helps focusing on processes that can facilitate a sociotechnical exploration of OBTA which is the research question asked in this thesis.

6.1.2 Sociotechnical imaginaries

Sociotechnical imaginaries are both connected to, and respond to social imaginaries (Jasanoff, 2015). As Jasanoff (2015) details, the role of social imaginaries in co-producing social, cultural or political phenomena has been studied from a wide range of perspectives (Anderson, 2006; Appadurai, 1996; Adams et al., 2015; Adams, 2012; Ezrahi, 2012; Lash, 2012).

A number of previous studies have applied social imaginaries to exploring Web-related concepts and issues. For example, Hofmann (2016) draws upon Ezrahi (2012) to highlight the role of collective imaginaries in reproducing expectations, behaviour, perceptions, and new benchmarks. Hofmann (2016, pp.25-30) argues that multi-stakeholderism in Internet Governance can be described as a performative imaginary that gives meaning

to a disorderly world and renders Internet Governance coherent.[3] Additionally, Turow et al. (2015) draws on others to argue that a new form of social imaginary is formed via digital retailing where social discrimination is normalised, and Acquisti and Gross (2006) draws on Anderson (2006) to explore Facebook networks as an imagined community.

Jasanoff (2015) suggests that sociotechnical imaginaries have ties with Latour's Actor Network Theory (ANT). They are similar in that they implicate the materiality of technologies in both stability and instability of social relations, yet they are different in the way they treat 'power' and 'normativity' (Jasanoff, 2015, pp.15). Whilst ANT considers the world flat and treats heterogeneous actors with similar weight in the network, sociotechnical imaginaries react to this 'flatness' through focusing on imagination and its capacity for 'power' and 'action' that are specific characteristics of 'human agents and institutions,' when cutting through the binary of structure and agency (Jasanoff, 2015, pp.17).

Sociotechnical imaginaries might be articulated by different actor groups with different interests or agendas (Jasanoff, 2015, pp. 4). They can be applied to understanding how alternative futures are framed, and actions in space are enabled or restricted. They are as much about utopias as they are about dystopias, as imagining a desired future links with shared fears of harms (Jasanoff, 2015).

In this thesis, the concept of sociotechnical imaginaries is used in the second part of the research that involves engaging with key informants from different actor groups to explore the affordances of the model (TATE) from their perspectives. Sociotechnical imaginaries help exploring some of the collective imaginaries surrounding transparency in OBTA that can provide insight about the current dynamics of OBTA ecosystem.

6.2 Methodology

The first part of the research, as outlined in the previous section, involves conceptualising a model for documenting and querying processes and decisions in OBTA in answer to the research question. The second part, involves analyzing the affordances of the model, and exploring the dynamics of the current state of OBTA. In both parts, the critique of the model and its approach for documenting and communicating OBTA operational details is an inextricable part of the research. This is because as discussed in the previous chapter, designing a mechanism for providing qualified and meaningful transparency is very challenging. From a technical perspective, the speculative approach provides a way to enable the critique of TATE prior to any development. Regardless of the result about the affordances of the model, the speculations about if and how the model could come

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[3]Internet Governance is often understood as the efforts for 'addressing, questioning and renegotiating Internet-related coordination practices' (Hofmann et al., 2017, pp.25).

to use can contribute to a better understanding of OBTA and the current dynamics in their ecosystem.

The steps taken in conducting the research in these two parts are described in what follows.

6.2.1   Conceptualising a model (TATE)

The first part of the research aims to look for answers to ***How can the operational details behind the analytic and administrative processes of OBTA be documented and communicated in an interoperable way across different actor groups?*** The first part of the research therefore, is concerned with conceptualising a model called TATE (Targeted Advertising Tracking Extension) within the framework of speculative design, for systematic documentation and communication of analytic and administrative operational details behind a targeted ad in an interoperable way across different actor groups.

As noted earlier, from a technical perspective, framing TATE with speculative design and keeping the design within the boundaries of conceptualisation as opposed to development, appears more suitable than strictly following a software development approach for the purpose of this thesis. Without being concerned with development challenges, and capacities could be explored through conceptualising a model and exploring its affordances.

More recently, research in the area of algorithmic transparency in behavioural advertising, have also used speculative design as a method for exploring how operational details behind the ads can be communicated to Web users, by engaging with users about explanations about the ads (Eslami et al., 2018). In addition to using speculative design as a method for engaging with key informants about if and how operational details might be communicated via a conceptualised model, designing TATE also involves imagining who the users of the model would be, what it would be used for, and how it would be used, that are detailed in what follows.

6.2.1.1   Imagined users and uses

To start the task of conceptualising the model, it is essential to specify the imagined uses and users of the model. It was argued in chapter 4 that understanding where and when OBTA can raise concerns requires more empirical research that is currently challenging due to opacity in the OBTA ecosystem. It was argued that the concerns include, but are not limited to, understanding how direct and indirect forms of discrimination and exclusion can occur, if and how OBTA have social and political implications, when and where they can amplify existing social issues such as inequalities, if and how OBTA they

are exploited for problematic practices, and if so, how such misuses can be prevented, safeguards can be designed, and the necessary critical interventions can be made. Meanwhile, enabling research as a specific usage of TATE, could refer to enabling 'governance' and 'regulation research', and identifying 'accountability gaps' in addition to academic and journalistic sociotechnical research. These terms are detailed in what follows.

For the purpose of this thesis, governance refers to a definition provided by (Hofmann et al., 2017, pp.1412-1417). In this definition governance is considered a form of 'reflexive coordination' [pp.1406] that occurs when the prior coordination fails, and conflicts of interest arise or become visible, that require parties opening up to questioning, renegotiating and re-dressing coordination practices (Hofmann et al., 2017, pp.1412-1417). Also, for the purpose of this thesis it is built upon Caplan et al. (2018, pp.10) to consider algorithmic accountability as

> 'assignment of responsibility for how an algorithm is created and its impact on society; if harm occurs, accountable systems include a mechanism for redress.'

Additionally, in this thesis 'accountability gaps' is used to refer to identifying non-compliance with best practices or safe-guards, or where they are accidentally or implicitly circumvented.

Depending on the above imagined uses, conceptualising the model would require imagining the users of the model. Determining who the users of the software are, is necessary for analysing and identifying requirements that is often the first step in many software development models. However, in this thesis, determining who the users of TATE could be is a sociotechnical inquiry, and determining this would need information for which the research is designed for in the first place. All of this raises various questions about how the design of the model should be specified and the ways that the model could potentially be used.

Could the design be tailored for academic and journalistic sociotechnical research? Should the design of TATE be tailored for usage by policy makers to research where and when existing safeguards can fall short in preventing harm? Could TATE be designed for the web users as a means for seeing the collection, flow, and usage of their data? If so, should the information be documented in a way that is specific to individuals? What would be the implications of this? Would any of these design choices not raise privacy or security concerns? Should this information be documented on an individual level but be only visible at an aggregate level? Would this provide enough details about the analytic processes involved in a way that can be used for research? If so, how could this data be made accessible to academic and journalistic researchers? Could TATE be designed for companies for example, as a self-auditing mechanism to flag problems, identify gaps in

safeguards by getting an overview on their analytic and administrative operational details? If so, should such view be restricted to their own company or could they also view information from other companies with whom they have trade relationships? What could be the implications of this? Could it be designed in a way that enables disclosing operational details as part of trust-building mechanisms where OBTA do not raise concerns? What would be the implications of using TATE in this way? Could TATE be designed for companies to prepare for providing an overview over their operational details when there are issues? Could this qualify as a step towards CSR? Could TATE be designed in a way that can serve multiple stakeholders and purposes? What would be the implications of this? In what ways could TATE could be mistakenly or wrongfully used and what would be the implications of this?

The questions could go on. Speculative design enables engaging with stakeholders and disciplines to problematise the assumptions underlying the design as a means to explore answers to some of these questions. Although it would be unlikely that all of the above questions would be answered, yet this approach to design can have various benefits for conducting the research. In a broad sense, it can enable interdisciplinary considerations, that would not have been possible within the limited resources of a PhD research otherwise. As exemplified in the above questions, there are potential privacy and security challenges, and various social, legal, governance, and technical questions that cannot be answered in separation from each other. Additionally, from a technical perspective, if designed within a conventional software engineering framing as opposed to speculative design, there would have been various other questions, for example, on scalability and latency, or actionable interface design. Such considerations can still be investigated at a later stage if TATE was to be developed as an operational artefact.

Meanwhile, from the technical perspective, one of the noted imagined users above needs to be selected for starting the conceptualization. This selection has to be merely a pragmatic choice based on available resources as analysing the data from the interviews would ultimately shed light on the affordances of TATE for this and other imagined users and uses. To keep the possibilities open for a later time, a pragmatic approach could be to design TATE for Web users, as this will enable later adjustments of the scope, for example, to only make the data accessible to academic researchers. Moreover, analyzing the requirements on other levels (e.g. companies, governance bodies, etc.), requires further knowledge elicitation from domain experts who have expertise in their domain sectors, that could require ethnographic research and sector specific interviews. However, as a web user, I have the means to analyze the requirements on an individual level. Moreover, a model devised for meeting individual requirements can still be used on other levels (e.g. academic and journalistic researchers) albeit on a limited scale: A consideration is that the model conceptualized on the individual level, will document details about web users interactions such as cookies and their content, that communicating them will require privacy considerations. However, if the main idea behind TATE was considered

appropriate to proceed to development, then the appropriate levels of documentation and details could be adjusted according to the decision about the appropriate uses and users. For example, if it was decided that the data could be considered public, this can be adjusted to only document the information related to the OBTA companies that do not capture or reveal any consumer information (e.g. cookies, etc.).

The following sections describe the steps taken in the first part of the research and explore how to answer to the question ***How can the operational details behind the analytic and administrative processes of OBTA be documented and communicated in an interoperable way across different actor groups?*** using a combination of methods including speculative design, and requirement analysis.

6.2.1.2   Documenting and querying provenance of analytic and administrative processes

The first step in answering the question is to develop an initial understanding of OBTA procedures and environments and form a big picture, that through iterative processes can be enriched. The sources used for this have been very wide. In what follows, the formal and informal sources used for this are described.

Formal literature includes peer reviewed and non-peer reviewed papers, and technical standard documentations. Key examples include Acar et al. (2014)'s investigation on cookie syncing, the works of the W3C Tracking Protection Working Group (W3C, 2011) on the Tracking Preference Expression (DNT) (Fielding and Singer, 2019), its server side implementation by some of the websites noted in W3C (2016), and Tracking Compliance and Scope (W3C, 2015) to complement modelling the behaviour of an OBTA system and its internal interactions.

Other sources include grey literature and informal sources. Grey literature includes blog posts, patents, popular media, OBTA companies PR materials, self-help guides, court hearings, and more. These literature are not directly used and instead have informed and inspired the overall understanding of the OBTA ecosystem and their operations. Additionally, various informal chats with OBTA stakeholders, as well as formal interviews have shaped the understanding of OBTA in this thesis. The following paragraphs provide examples of key informal sources and grey literature used.

Examples of grey literature that informed the general understanding of non-observable interactions (e.g. server to server interactions) include guides provided by Google Developers on their cookie matching processes (Google, 2015), Facebook's guide on measuring conversions (Facebook, 2014). Examples of informal sources that informed the understanding of observable interactions include exploring observable interactions on the browser via technical tools: An open source measurement tool called Fourthparty (Fourthparty) was used to monitor http interactions with the browser on two pages of a

website. Fourthparty has provisions that allows differentiating 1st and 3rd party cookies, and provides a description of http interactions in a database. Furthermore, a test implementation of an open source ad server helped develop a holistic understanding of how a local ad server may operate OBTA mechanisms in the wild. Based on synthesising these sources over time, an initial understanding of the OBTA operations was developed that enabled forming a hypothetical scenario. This is detailed in what follows.

Conventional software engineering methodologies often involve requirement engineering. This can be an iterative process of deciding what should be the functionality of the model for documenting and communication operational details in OBTA and how it should perform for its imagined user and usage.

Based on the sources noted above, a hypothetical OBTA scenario was formed. Since it was decided that the model is to be conceptualised for the Web users in the first instance, the scenario was scoped to actor groups involved in collecting, processing and exchanging users data in the scenario. Stakeholders were scoped from section 6.2.1.1 to this scenario, and the user actions between them were defined. As a result, the notion of 'stakeholders' and/or 'actor groups' in this thesis is used in two different ways. In this part of the research that is concerned with conceptualising the model for usage by web users, stakeholders refer to the actor groups involved in the scenario that their operational details are required to be captured in TATE to be communicated to the Web user, such as publishers, advertising companies, ad brokers and data brokers. In the second part of the research that is concerned with conducting interviews, stakeholders refer to a broader set of actor groups defined in section 6.2.1.1 that could be interested in re-purposing the model for research in specific domains such as academic and journalistic research, or governance and regulation research. This is different from a conventional software engineering method, whereby as part of requirement engineering, stakeholder analysis is conducted, an artefact is designed, and interviews are conducted as a means of evaluating the model. The aim in this thesis, is not to evaluate TATE as an operational artefact, but rather, to use TATE as a means of provoking discussions about wider issues such as concerns surrounding OBTA, transparency, and as well as TATE's affordances and its the promises and challenges for different actor groups. This enables experimenting with if and how new forms of agency can be identified and mobilised to think differently about the future of OBTA and the Web.

Following this, the user actions were defined, and the sequence of interactions between their actor groups were decomposed. The elements and stages of decomposition of the scenario are based on sources noted in section 6.2.1.1. A sequence diagram is provided that illustrates the sequence of interactions between main actors in the OBTA. For this illustration Unified Modelling Language (UML) diagrams were used, that are commonly used in design and development of object-oriented software systems.

Unified Modeling Language (UML) specification from the Object Management Group (OMG) (OMG, 2011) is a design method in software engineering that support the development and maintenance of software products, and understanding and managing complexity, enhance the quality of the software products, and enable re-visiting the relationship between actors, data and processes at any time during the software design and development process, debugging, and afterwards. Sequence diagram is a type of behavioural UML diagram that can be used to model the interaction between actors in an environment, and specify the details of these interactions to provide an overall view of the system (OMG, 2011).

The next step involved abstracting key operational details from a variety of sources including Ramirez et al. (2016) and the sequence diagram (section 7.1.4.3). These abstractions were then used for identifying early requirements. This was followed by conceptualising a data model that can facilitate documenting and querying the key operational details as determined by the requirement analysis in the previous step. Based on the combination of activities, their inputs and outputs and the actor groups involved, the models requirements were identified, and a data model was defined that enables the conceptualised model to facilitate documenting and querying the operational details behind a targeted ad.

In the next step, it was explored if and how this model can be mapped into an existing data model to enable interoperability across domains, and at the same time, facilitate systematic documentation overtime and enable querying the logs about operational details and decisions in a machine readable format. For this, provenance and the W3C PROV data model were chosen. The rationale behind this is detailed in what follows.

Documenting data provenance is often recommended as a best practice for companies to avoid discriminatory practices (Gebru et al., 2018; World Economic Forum Global Future Council on Human Rights 2016–2018, 2018), and as a means for supporting accountability (Weitzner et al., 2008). Provenance, refers to 'the information about entities, activities, and people involved in producing a piece of data or thing, which can be used to form assessments about its quality, reliability or trustworthiness' (Groth and Moreau (eds.), 2013). More recently, similar research in the area of algorithmic transparency and accountability has explored how decision provenance in machine learning models can be documented and tracked (Singh et al., 2019).

A specification, known as Provenance (PROV) specified by the World Wide Web Consortium (W3C) provides a standardised model for describing the provenance of data on the Web as it flows within and between heterogeneous systems. Therefore, PROV can record and generate information about the quality of data whilst ensuring interoperability and remaining domain agnostic (Moreau et al., 2013a,b). This has made a wide range of domains enabled to adopt PROV, including but not limited to, the scientific workflows (e.g. astronomy) and healthcare.

The support for interoperability in describing the flow of the data across heterogeneous systems makes PROV suitable for the purpose of documenting and querying OBTA operational details in answering the research question. Moreover, PROV is part of the family of the Semantic Web (Berners-Lee et al., 2001) technologies that aim to facilitate making information meaningful and understandable for computers in order to enhance cooperation between humans and machines (Berners-Lee et al., 2001). From a technological standpoint, the realisation of the Semantic Web requires creation and exchange of ontologies to 'provide the vocabulary needed for discussion' between consumer and producer agents, so that agents can 'reach a shared understanding' (Berners-Lee et al., 2001), as well as Linked Data, which would 'actually connect the semantic web (Berners-Lee, 2006).' Using PROV for documenting OBTA operational details can therefore, enable a machine readable communication of these details that has a potential value for facilitating research and investigation.

Therefore, TATE's data model is mapped to the W3C PROV data model for interoperability and reliability where based on the sequence diagram and guided by the PROV data model, all of the steps of the hypothetical scenario (7.1.2) are expressed in PROV Notation (PROV-N). PROV-N is a human readable representation of PROV, and annotated as a lightweight ontology. The next step involves validating the mode. For this, examples are provided illustrating how the required operational details can be discovered from the PROV representations via queries, and PROV details are retrieved from the communicated operational details.

6.2.2   Key informant interviews

The second part of the research involves key informant interviews and asking *if TATE can be imagined to be used? and if so, by whom? and how? and what are its promises and challenges?* to explore the imagined affordances of TATE for enhancing transparency, and provoke wider discussions.

The value of the proposed approach is in creating a space for thinking across the boundaries of stakeholders and disciplines about new ways of thinking about transparency in OBTA, and some of the questions outlined in section 6.2.1.1. The benefit of this is twofolds. 1. it can enable knowledge elicitation for specifying TATE's users, requirements and features that can enable revisiting requirements of the model where adjustments are recommended to the requirements for the imagined uses and users of the model, 2. it can provide insight about the dynamics of the OBTA ecosystem and some of the sociotechnical imaginaries that can shape our expectations of the future. *The combination of these, along with the technical processes involved in the first part provide a sociotechnical understanding OBTA that can inform a sociotechnical future making for the Web.* In what follows, the steps taken in the second part of the research are described.

6.2.2.1 Data Collection

Key informant interviews were used for data collection. This choice enables engaging across disciplines and stakeholders within the time frame and resources of a PhD research. An ethics application was submitted to the ethics committee of the university and approved (Ethics reference number: 24296).

The theoretical approach adopted in Chapter 2 guides the approach taken in analysing the interviews. Haraway (1988)'s 'situatedness' and Harding (1993)'s strong objectivity are a reminder that the research is shaped by the limitations of the means and the instruments of the research and the researcher's stand-point should be considered when analysing and interpreting the results. In this process, to be reflexive about one's standpoint as a researcher, researchers examine how their experiences might have shaped the research process, the epistemological assumptions of the design of the research, the interpretative lens for the analysis, and the claims of the research. In this research there are key aspects of my experience that should be considered: The first consideration is that the Web has been, and continues to be, an integral and inseparable part of my life. Studying Web Science has provided me with a more critical lens for thinking about the Web, and the works of Donna Haraway have been a key influence on my stance in rejecting anti-tech rhetoric, and looking for an optimistic reflexivity instead. Also, conducting the interviews have been a learning curve and my interview competences were improved towards the latter interviews.

Where possible, key informants or points of contacts were approached through existing personal contacts, and there were also cases of 'snowball or chain sampling' (Patton, 2009, 237). Key informants or a point of contact were often emailed with a description of the model and the aim of the interviews. It should be noted that both of these have evolved during the time of interviews as 1. the research progressed and evolved and 2. a more appropriate vocabulary for describing the model and aim of interviews was developed over time. Therefore, it is possible that the description of the model at the time of inviting key informants to the interview has not remained consistent, and bares differences with its description as of today. With these considerations in mind, the following sections describe the steps taken.

The selection criterion decided prior to the interviews was being directly involved in OBTA technologies and practices, be it on the side of design and development, business, policy, or research. This criterion is intentionally chosen to be considerably wider than the stakeholder analysis described in section 6.2.1.2 due the considerations for speculative design that were detailed in section 6.2.1 about keeping the possibilities open for the imagined users and uses of TATE. To re-emphasise the difference, the stakeholder analysis in section 6.2.1.2 is scoped to the actor groups involved in a typical OBTA scenario as the conceptual model is concerned with documenting and communicating OBTA operational details, whereas, the interview selection criterion includes actor groups that might be

interested in re-purposing TATE, for example, for research purposes, including academic, governance and regulation research.

Moreover, in practice, the selection critereon was not strictly followed, and was broadened further in favour of engaging across disciplines, and for pragmatic reasons. More specifically, in one case, a key informant was approached due to their design expertise that did not directly involve OBTA, but the interview proved to be very relevant to this research and it was not excluded. In another occasion, contacting a key informant from a company directly engaged with OBTA, led to several interviews with a number of their scientists/researchers/technologists, some of whom did not directly engage with OBTA but were mostly in the domain of consumer behaviour/behavioural research. From these interviews, where key informants expertise has not been determined relevant to OBTA, they have been excluded.

It should be clarified that whilst the interview selection criterion was broader than the stakeholder analysis conducted for conceptualising the model as described in section 6.2.1.2, the interviews do not cover all of these actor groups. This is justified within the framing of speculative design as a pragmatic choice that instead enabled having interviews with a broader set of potential imagined users of TATE, including participants from domains such as journalism, public policy, Internet NGOs, ad-tech companies, publishing, etc. The speculative element means that TATE does not intend to be operational and aims to provoke discussions about transparency in OBTA, for example, the promises and challenges of transparency for OBTA and the Web, and experiment with an approach to explore if and how new ways of thinking about the future of OBTA and the Web can be identified. This is underpinned in the theoretical approach adopted in this thesis that encourages embracing partial solutions that can experiment with cultivating capacities for driving positive change.

Regardless of whether the interview was/was not secured, where it seemed appropriate, an introduction to other potential key informants was requested from the participants or the point of contact, or themselves offered to do so. Overall, 58 persons based in US, UK, EU, and Australia were approached mostly via email (one exception) and invited to interviews. Out of this, 25 interviews with 24 key informants interviews were conducted, making non-participation 34. In some occasions the participant suggested to have an initial informal chat before the formal interviews. This led to 5 informal chats. Whilst these chats were not recorded or directly analysed as part of the thesis, they have informed the overall processes. In 3 of these cases, the informal chats were agreed to be followed up with a formal interview with the same person or a colleague, but eventually did not lead to interviews. Meanwhile, there was an occasion, where after an interview with a key informant, they helped setting up an interview with their colleague on the same day that were not previously approached via email.

As a result, in total, 25 interviews were conducted (one repeat interview). Out of these, three interviews were excluded where the consent form was not returned after the interview, or the participant was identified as not meeting the selection criteria. From those included, two interviews were only partly transcribed due to noisy environment, and/or irrelevant discussions. Table 6.1 illustrates the number of interviews conducted and transcribed with each stakeholder group.

stakeholder	n=	id
governance and public policy	5 (-1 not transcribed)	p2; p18; p19; p20; p21; p24
Ad-tech	5 (one repeat)	p1; p9; p11; p12; p13; p14
Publishing industry	3	p14; p15; p20
Academic	4 (-1 excluded (p23))	p10; p17; p25
Consumer advocacy	2 (-1 excluded)	p16; p22
Industry researcher	6 (-1 excluded (p3))	p4; p5; p6; p7; p8
total conducted	25	
total transcribed	21 (including one repeat)	

TABLE 6.1:   Interview Details.

In the above table, governance and public policy group includes regulatory bodies. As described earlier, in this thesis, regulation, regulation research and governance are considered defined by Hofmann et al. (2017, pp.25-26).

The approach to sampling has been flexible, since the time constraints did not allow saturation. The limitation of this approach has been that as illustrated in table 6.1, the number of key informants are not evenly distributed across the stakeholder groups and there are gaps in participants from stakeholder groups (e.g. browser vendors). These limitations are justified against the benefits of snowball sampling method that enabled reaching a wider range of key informants than what would have using other methods. The approach to data collection and the settings of the interviews are detailed in what follows.

Data collection methods include inviting key informants to interviews, collecting mini-survey and consent forms, audio recording and in some cases additional note taking. The mini-survey was designed and given to key informants prior to the interviews to enable self-reported stakeholder analysis by asking the participants to categorise themselves within the most relevant stakeholder group(s). Random numbers were assigned to the consent form and the pre-interview mini-survey. Mini-surveys were used to form an understanding about the data in relation to the stakeholder groups. However, during the process, it was realised that stakeholder groups are not homogeneous, particularly at industry level. As a result, the stakeholder groups are generalised.

Initially the interviews were more structured and a set of questions had been prepared to ask. However, in many cases, the interview was unfolded in such a way that these questions were not, or could not be asked. For example, where participants discussed issues that were more relevant to their area of expertise or experience, or participants did not have answers to the questions asked. Furthermore, it was noticed that participants became more conscious of the interview with constant questioning. As a result, although the interviews were planned and initially started as more structured, they became less unstructured. The format was changed to present the on-going research of this thesis (including the model) in the beginning of the interviews either verbally or with the aid of PowerPoint slides, before asking the participants if they had comments on TATE, and if and to what extent they (dis)agreed with the consumer and industry concerns that were outlined as part of the presentation, potential approaches for addressing them, and the role of transparency and capacities for it in the OBTA ecosystem. As a result, in the early interviews and in interviews where time was restricted, the presentation was skipped and instead the interview was started with a brief description of the research and the model.

Some of the key informants only reflected on their own perception of the issues, solutions, transparency and TATE, whereas others reflected on what they considered to be the perception of their affiliated stakeholder group, or other stakeholder groups. Some of these views were then fed back into consecutive interviews to provoke new discussions. The shift from a more structured format to semi-structured was advantageous on many levels. The flow of information was less disrupted, and the participants were less reminded about the formal nature of the conversations. Secondly, sometimes stories were shared that offered more important information than what an answer to the questions would have been.

The interviews were conducted in a combination of settings: in person (at a suitable place suggested by the participant), online and on the phone. The interviews were aimed to last approx. 45-60 minutes. However, their duration varied from approx. 25 minutes to 90 minutes. In at least one occasion the participant was accompanied by a non-participant (oral consent for recording was given), and their engagement in the interview was mainly restricted to asking questions from me. In another occasion the on-going research was first presented work to a group, and engaged in questions and answers and discussion about the work during the session, and then individual participants were invited to separate interviews. During this presentation session, there were non-participants who contributed to the discussions after the presentation. Their data were not directly used in the analysis but informed the research.

In addition to the general research questions mentioned in the beginning of this chapter, other questions were asked such as participants line of work, and similar questions surrounding ***if and how TATE could be speculated come to use? By whom? (Individuals, governance bodies, companies, etc.) What are the incentives? And***

what would be the promises or challenges in doing so? and in many cases the participants were asked to exclude concerns such as scalability, and latency.

The following list exemplifies some of the questions in relation to the model's affordances. These includes but is not limited to questions about the affordances of the model for its imagined users and uses. Examples include could you imagine TATE being used for

- Supporting inquiries about operational details, the data, algorithms and companies made by individuals, public, and academic or journalistic researchers? ,

- Enabling oversight for governance bodies, for example, to flag gaps in existing technological and governance safeguards, and help identifying problematic practices, and investigate how mechanisms can be devised for ensuring that data are not collected and used in ways that are detrimental to individuals and groups? [4]

- Enabling self-auditing for companies, to help identifying, restricting and treating problems; supporting trust-building mechanisms by facilitating systematic communication of operational details towards substantiating claims to trustworthiness; as part of CSR focused initiatives for market differentiation?

As a result, examples of questions include (but are not limited to), could TATE be imagined to be used:

- on a public level (if the information was presented in an aggregate form)?

- on a research level (e.g. for academic or journalistic researchers)?

- on an individual level for getting an overview over OBTA activities (e.g. collection, analysis, usage, etc.)?

- on an industry level for documenting and communicating operational details, for example, for market differentiation based on social corporate responsibility?

- on an Internet Governance and public policy level, for example, as an auditing tool, or as a means to facilitate researching the sociotechnical relations to identify where safeguards fall short? and investigate how mechanisms can be devised to ensure that data are not collected and used in ways that are detrimental to individuals and groups.

- on regulation research level, for example, for researchers, journalists, and policy makers to research the interplay of OBTA practices, technologies, and governance. For the purpose of this thesis, Hofmann et al. (2017, pp.25-26)'s definition is adopted:

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[4]As noted before, for defining governance this thesis draws on Hofmann et al. (2017) who use the term to refer to 'reflexive coordination' that occurs when the prior coordination give rise to conflicts of interest that require engagement within and between stakeholder groups to scrutinise and renegotiate coordination practices (Hofmann et al., 2017, pp.25).

> 'Regulatory actors, private or public, assess their options to intervene in a specific field and use the means they deem effective to achieve a desired outcome. Regulation research studies the implementation and impact of these interventions.'

- could you imagine this model to be used for other purposes?

- what do you think should be done for addressing the concerns?

- what would be the risks and challenges of using the model this way?

In addition to above, some of the interviews involved asking one or more questions outlined in section 6.2.1.1 and 6.2.2.1. The next stage after data collection involved familiarisation with the data from the interviews by listening to the audio recordings. Following this, the interviews were transcribed (in some occasions with the help of a speech recognition software (Dragon Dictate)). Although efforts have been made to transcribe as close as possible to the audio recordings, it is possible that some incomprehensible words are missed or misheard. Transcriptions are edited and modified where there has been risks of potentially identifiable information, or for removing repetitions, improving clarity, grammar, and punctuation.

6.2.2.2   Analysis

The analysis has been inspired by the method of thematic analysis, for finding patterns of meaning in qualitative data (Braun and Clarke, 2013). Themes generated are interpretative and analytic, and they reflect the researcher's analysis and interpretation of the data. The processes of generating themes involved finding patterns of meaning in relation to the theories of affordances, and sociotechnical imaginaries. Two broad themes were generated: cases where key informants could not imagine any uses for TATE, and where TATE was imagined to offer capacities for its imagined uses and users (individuals/researchers, companies, governance bodies). In both themes, discuss the promises and/or challenges of these speculations were discussed. Where other sociotechnical imaginaries for moving forwards from the current state of OBTA towards addressing the concerns and questions, they were outline, and analyzed. Although generating themes and sub-themes, and the analysis has been predominantly based on the transcripts of the formal interviews, the analysis has also been informed by my notes on observations during the data collection, the informal chats that with prospective respondents that did not wish to be interviewed, and any other informal sources that have been described in this section.

In all cases, the themes have been interpretative. The discussion, descriptions, and analysis provided in Chapter 8 therefore, reflects the researcher's interpretation of the data, whilst the concepts and theories of sociotechnical imaginaries and affordances have

inspired these themes. Sociotechnical imaginaries were described earlier in this chapter. In what follows a brief overview of the theories and concepts of affordances are provided.

Theories of affordances have been used for analysis in STS, psychology, media studies, communication studies and design studies amongst other disciplines (Neff et al., 2012; Nagy and Neff, 2015; Davis and Chouinard, 2016). As Davis and Chouinard (2016, 241) points out this sometimes comes with shortcomings, such as a tendency to think of affordances as a binary concept in which technological artefacts either afford or not, and a tendency to simplify 'diverse subjects and circumstances.'

In their 2015 paper, Nagy and Neff (2015) introduce 'imagined affordances' that contrasts with previous uses of affordances. Imagined affordances, do not consider affordances to be resulted purely from design features, or users practices. Instead of thinking of technologies to have fixed capacities, 'imagined affordances' enables exploring the expectations, perceptions, and intentions of the designers, and the users of technologies whilst taking into account the materiality of technologies (Nagy and Neff, 2015, pp.1). Similarly, Davis and Chouinard (2016)'s definition extends this further:

> 'Broadly, affordance refers to the range of functions and constraints that an object provides for, and places upon, structurally situated subjects. In the context of this article, the analytic import of affordance is its capacity to recognize technology as efficacious, without falling prey to technological determinism (Neff et al., 2012). Indeed, affordances are the dynamic link between subjects and objects within sociotechnical systems.'

Therefore, as Neff et al. (2012) explain by drawing on others, affordances relate the capacities of technological artefacts to user's purpose (Faraj and Azad, 2012), and therefore, affordances are not about artefacts (Fayard and Weeks, 2007) as technologies are co-produced by a range of human and non-human actors (Latour, 1992). Imagined affordances can be linked to a perspective of 'symbiotic agency' (Neff and Nagy, 2016, pp.4915) that is concerned with both how the materiality of technology mediates human agency, and how human agency impacts the way technologies are used (Neff and Nagy, 2016, pp.4926). This linkage allows considering the design features, and the human actions inseparable when thinking about agency (Neff and Nagy, 2016, pp.4927).

Inspired by the above understanding of affordances, the analysis in this thesis aims to explore agential capacities of the proposed sociotechnical intervention, from participants speculations about the capacities and limitations of the conceptual model. After analyzing the model's affordances, it is discussed how these speculations might be used for sociotechnical research as a direction to be explored as part of future work in the final chapter. The analysis on the affordances of the model on various levels is therefore not argumentative about whether or not the model can afford transparency in OBTA. But

rather intends to describe how the model can be imagined to be used, or be excluded from imagination, and to bring into light some of the promises and challenges.

6.3   Conclusion

This chapter outlined the steps taken for answering two main research questions that the processes of answering them can contribute to the main aim of the thesis which is to develop a sociotechnical understanding of OBTA. First it was asked ***How can the operational details behind the analytic and administrative processes of OBTA be documented and communicated in an interoperable way across different actor groups?*** For this, the first part for the research was designed within the framework of speculative design that employed elements of software engineering and requirement engineering methods to conceptualise a model for documenting and querying the provenance of operational details behind a targeted ad, using PROV and semantic web technologies.

It was then asked if TATE ***can be imagined to be used? and if so, by whom? and how? and what are its promises and challenges?***, for which the second part of the research was designed using key informant interviews, using thematic analysis inspired by the concepts of sociotechnical imaginaries and imagined affordances. The analysis was guided by theories and concepts of sociotechnical imaginaries, and affordances.

The proposed methodology in this chapter for looking for answers to the above questions comes with benefits and limitations. On the one hand, the speculative framing and omitting development and its practical technical and legal challenges from the research means that if the idea behind the model turns out to be an appropriate way of moving forwards, developing the model and making it usable will require substantial future research about the practical concerns such as privacy and security considerations (e.g. access control), practical governance questions about where, how, and in what fashion (e.g de/centralised) the model could be stored and administered (E.g. browser, independent agency, etc.), technical questions about scalability, latency, interface and questions, as well as questions about how to aggregate the provenance data in ways that do not raise privacy concerns, and present them in actionable and meaningful ways.

The speculative framing enables going beyond the incremental approaches in addressing the concerns, and by putting aside development and its practical challenges, liberate imagination to explore alternative ways of thinking about how to move forwards from the current state of OBTA towards addressing the concerns. Moreover, extrapolations about the future can bring into light an informed social commentary about the present dynamics of OBTA and enable a sociotechnical research. All of this can help developing a sociotechnical understanding of OBTA which is the main aim of this thesis, and that

can be used for a sociotechnical future-making for the Web that is currently urgently required.

Chapter 7

Speculative design of TATE

The previous chapter outlined the research design and the methodological steps for conducting the research in this thesis. The first part of the research was set to speculatively design a model for enhancing operational transparency in OBTA using academic and grey literature described in section 6.2.1, and the second part was set to conduct key informant interviews to analyse the affordances of the for its imagined users as described in section 6.2.2. This chapter focuses on the first part of the research that involves conceptualising a model called TATE (Targeted advertising Tracking Extension) for documenting and communicating the analytic and administrative operational details behind a targeted in an interoperable way across different actor groups.

As described in chapter 6, the speculative framing of the model enables experimenting with if and how the model could be used to provoke wider discussions, that can enable both knowledge elicitation for a potential second iteration of the model, as well as exploring the dynamics of the current state of OBTA and capacities for positive change. The processes involved in this, ultimately aim to provide a sociotechnical understanding of OBTA technologies and practices that is crucial for thinking about the future of the Web. This chapter details the process involved in conceptualising the model and ends by asking if and how the model **can be imagined to be used?, and if so, by whom? and how?, and what are its promises and challenges?** to be explored in the second part of the research.

7.1   Overview

Conceptualising the model includes stakeholder analysis, forming a hypothetical OBTA scenario, abstraction of the entities, agents, and activities in the scenario, and decomposition of the sequence of interactions between the stakeholders, detailed description of these interactions and finding core details that can enable research, mapping the model

into a standard model for interoperability, and validating the requirements by running example queries. The model incorporates the provisions of W3C DNT. The approach taken for conceptualising the model is iterative, which makes the critique of the model- to be collected in the next stage of the research in key informant interviews- an inextricable part of the design. As described in Chapter 6.2.1, the model was decided to be conceptualised for the Web users as its imagined users in the first instance for pragmatic reasons, but could be scoped at a later stage to be used for academic research. The summary of the aim and functionality of the model for its imagined use and user as detailed in section 6.2.2.1 are expressed in what follows.

Aim to provide an infrastructure for systematic communication of operational details, to enhance transparency in OBTA, and enable investigating the interplay of social and technical in OBTA.

Functionality The model enables documenting and querying the provenance of analytic and administrative processes and decisions in an interoperable and machine readable format across different actor groups.

7.1.1   Early Stakeholder Analysis

This section presents an early stakeholder analysis required for conceptualising the model through the processes that were described in Chapter 6.2.1.2. The main stakeholders in OBTA ecosystem are often categorised into *publishers*, *advertisers*, and *users* in the literature (Muthukrishnan, 2009). Sometimes it is also pointed to a layer mediating the interactions between these groups such as *Ad-networks* (Toubiana et al., 2010), *brokers*, and *dealers* (Guha et al., 2009). For example, Castelluccia et al. (2012, pp.4)'s classification includes publisher, advertiser, and the ad network. They describe that the advertiser is the entity that aims to advertise for a product or service, the publisher is the entity that owns website(s) and aims to generate revenue from displaying ads on their website, and the ad network is the entity that 'collects advertisements from the advertisers and places them on publisher sites' (Castelluccia et al., 2012, pp.4). For example, in the 'cost per click' model, when a user clicks on an ad, the ad network collects payments from the corresponding advertisers and pays a part of it to the publisher (Castelluccia et al., 2012, pp.4). As Castelluccia et al. (2012) argue, this makes ad networks commercially motivated to create complete profiles of users to enhance their optimisation for both publishers and advertisers.

Meanwhile, with the growth of OBTA industry there are new actor groups that have branched in between these actors. For example, *Demand Side Platform (DSP)* may be used by advertisers (ad agencies) to outsource trade management or programmatic bidding, and *Supply Side Platform (SSP)* may be delegated to do so on behalf of publishers. The ad exchange may only act as a *broker* between publishers and advertisers in the

RTB processes, or may also act as their *ad server*. Local or remote *CDN* may be used by publishers and/or advertisers to provide the bandwidth and volume needed for delivering digital assets, and more. Additionally, larger stakeholder groups have increasingly overlapping roles in the OBTA ecosystem. As a result, the boundaries between these stakeholders in many cases are not fixed and is fluid. Keeping this fluidity in mind, in a hypothetical OBTA scenario, stakeholders can be loosely categorised as illustrated in Figure 7.1. The following paragraphs describe the actor groups illustrated in this figure.

User Agent (*UA*) can be defined as

> 'The client which initiates a request. These are often browsers, editors, spiders (web-traversing robots), or other end user tools.' (Fielding et al., 1999)

Therefore, *UA* is a key non-human actor that sends requests for retrieving resources from various online sources as shaped by browser vendor's design and implementation, and web user's preferences that can be different from the default settings.

Web user is an individual that browses and views a web page hosted by the publisher, whilst their browser preferences is interdependent on the usability and affordances of the browser settings for different groups of people, and their browsing habit might vary based on an underlying sociotechnical context. Publisher (*P1*) hosts a web page with an allocated space to a digital ad where advertiser (*AV*) is willing to display a targeted ad to a web user (e.g. contextual, re-targeted, behavioural, etc).

Furthermore, ad network and ad exchange are grouped together as an actor group named Ad Broker (*AB*), whose role is similar to an ad broker and revolves around matching a web user, device, or browsing history, with an ad, and an ad space. Similarly, data exchange, and Data Management Platform are grouped as a sociotechnical actor called (*DMP*), that act as data brokers as their respective roles revolve around online and offline tracking and providing data and metadata about the web user, device, or browsing history that can be merged and used in real time by other actors.

Additionally, (*P1*)'s CDN and ad server are grouped as a actor group called (*AS1*) that facilitates serving, be it ads, content or other digital assets. A distinction is made between the ad servers components, as the local and distributed component (*(LAS1)*) may engage in enhancing control over data for advertisers or publishers, and the remote and centralised component (*(RAS)*) may engage in its own data collection and exchange. In this sense, the remote component (*(RAS)*) may represent an identity management platform. Similarly, (*AV*)'s CDN and ad server are grouped as (*AS2*) with (*(LAS2)*) as local, and (*(RAS)*) as the remote components. Early identity management platforms (e.g. PRIME and PRIMELife Project) stemmed from privacy communities with an aim to enhance control and manage of personal data and identities. Today, identity
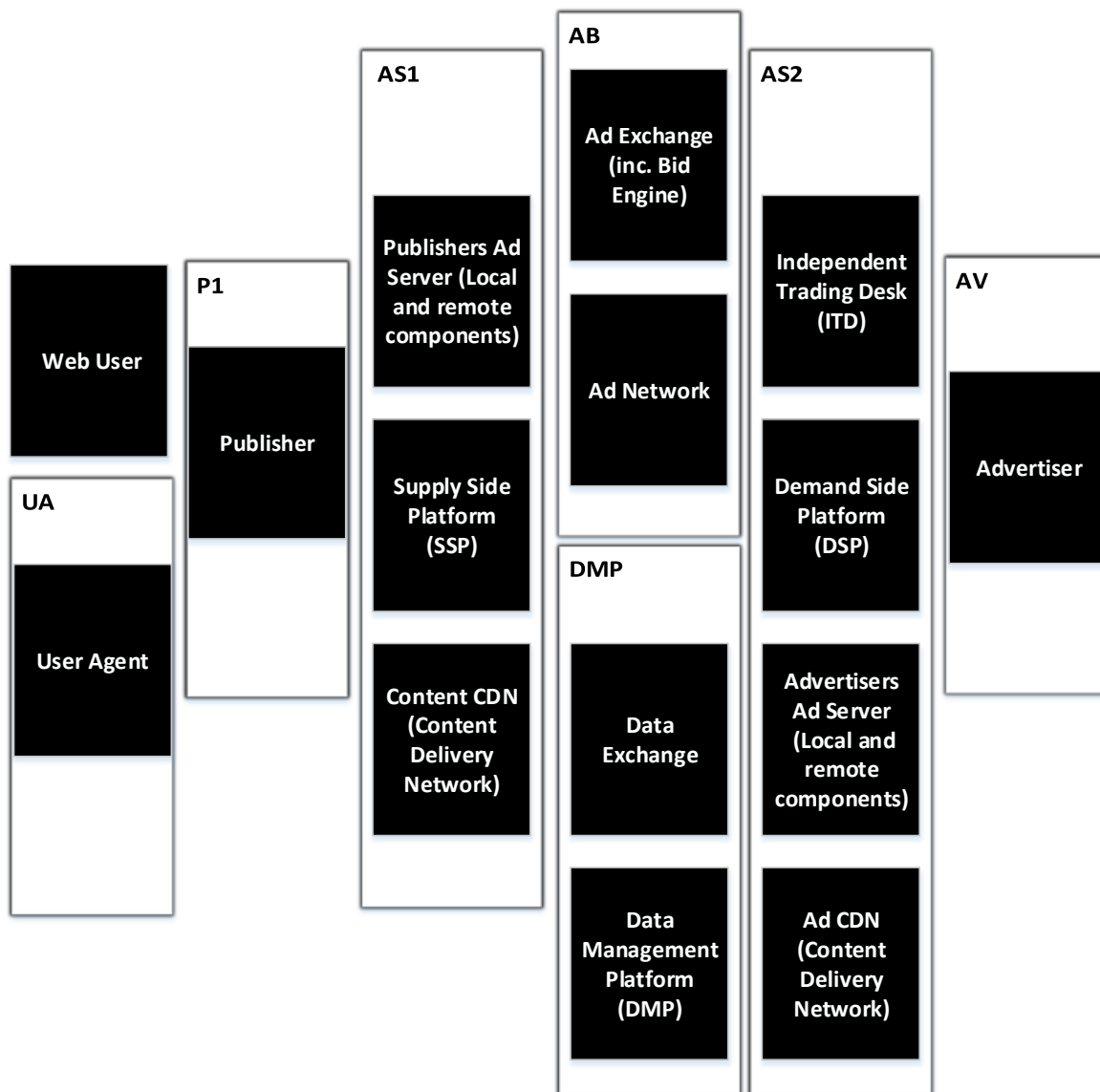
FIGURE 7.1: Early Stakeholder Analysis

Showing early stakeholder analysis from processes described in Chapter 6.2.1.2. The
Actor group key consists of **AS1**: SSP (Supply Side Platform); **AB**: AdBroker; **DMP**:
Data Management Platform/dataBroker; **AS2**: DSP (Demand Side Platform); **AV**:
Advertiser.

management platforms can gather customer data and profiles from a variety of sources in one centralised platform with access control mechanisms for these profiles to first-parties, and third-parties. Figure 7.1 illustrates key actor groups resulted from a stakeholder analysis as described in Section 7.1.1 and Section 6.2.1.2. The following section details how actor groups in the above figure engage in a basic hypothetical OBTA scenario through processes described in chapter 6.2.1.2.

7.1.2 Use Case Scenario

This section describes a hypothetical scenario for OBTA based on methodology described in section 6.2.1.1. The scenario is scoped to a basic OBTA cycle using cookies, 'Real Time Bidding (RTB)' (Yuan et al., 2013), 'cookie synchronisation' (Acar et al., 2014; Englehardt and Narayanan, 2016) or 'cookie matching' (Castelluccia et al., 2014; Papadopoulos et al., 2019), and 'conversion tracking' (Sharma and Chen, 2008). Acar et al. (2014) describe 'cookie syncing' as follows.

> 'Cookie syncing, a workaround to the Same-Origin Policy, allows different trackers to share user identifiers with each other. Besides being hard to detect, cookie syncing enables back-end server-to-server data merges hidden from public view.'

The Same-Origin Policy (SOP) (W3C, 2010) is a set of principles that prevent online resources loaded from one origin to be accessed or modified from another origin ('Mozilla', 2008). This requires all of the resources retrieved by a browser to be defined by a string containing the origin (i.e. url). Cookie syncing arrives with a number of privacy, transparency, and accountability concerns. For example, it can be used in combination with respawning cookies where the ID for user's browsing logs can be linked before cookie clearing to browsing logs after cookie clearing and then the ID can be passed by one domain to another (Acar et al., 2014).

RTB refers to real time auction for an advertiser's demand for an ad space, a publisher's space supplied for displaying advertisement, and a web user, user agent, or device visiting a page. Value of the 'eyeball' is often measured based on relevance (e.g. time, context, past browsing behaviour, device specifications, etc.), type of targeting, and price of the bid. RTB might be in combination of programmatic advertising (algorithmic matching) or without.

Conversion often refers to methods used for tracking if the visitor has viewed retailer's purchase page after being shown the ad. The interpretation of 'conversion' often depends on how it is defined in the contracts between stakeholders. This contract is related to payment models whereby advertisers only pay the publishers after a user has engaged in an event such as purchase, click, or has entered contact details.

To be able to demonstrate how the data flows in OBTA, a scenario is formed with its user actions described as follows. Part one of the scenario demonstrates an OBTA cycle with no existing cookies in the user agent. Part two considers all the cookies set in part one to be valid and existing on the browser. The web user is *Alice* in this scenario.

7.1.2.1   Alice first visiting

1. *Alice* starts a new browsing session (i.e. with an empty cache and no cookies).

2. *Alice* sets her browser Tracking Preference to 1 (enabled). Therefore, a DNT:1 signal is included in every request.

3. *Alice* visits publisher *P1*'s web page *(domain1.com)* for the first time with no prior cookies.

4. The targeted ad is displayed for *Alice* as part of the content of the publisher *P1*'s Web page.

5. *Alice* clicks on the displayed ad and gets directed to the retailers online store where an html element such as a conversion pixel is embedded for conversion tracking.

6. *Alice*'s session on *domain1.com* ends. End of Part One.

7.1.2.2   Alice revisiting

1. *Alice* visits publisher *P2*'s webpage *(domain4.com)* with all of the tracking cookies in Part one still valid.

2. The targeted ad is displayed on publisher *P2*'s Web page.

3. *Alice*'s session ends without clicking on the ad. End of Part Two.

7.1.3   General Requirements

As detailed in the previous chapter, determining the requirements of the model, is a two stage process consisting of an early and late requirement, and the final requirement can only be determined after the second facet of the research through interviews. This is because the current imagined user and uses of TATE might change, or requirements might need adjustments. However, an early requirement analysis, is needed for the purpose of conceptualizing the model and in order to be able to engage with stakeholders and explore capacities of the model for other imagined users and uses. As a result, as discussed in chapter 6.2.2.1, the general requirements are based on the imagining the user of TATE to be a web user (here Alice), and the imagined usage to be investigating the processes behind a targeted ad displayed to them.

In order to document and communicate OBTA operational details in the above scenario, descriptions of the operational details require to be provided by OBTA actors in such way that enables *Alice* to inspect and investigate all stages of the mechanism. This means that *Alice* could ask, and receive answers to, the following questions upon display of a behavioural ad:

- Req1: *Why have I been targeted with this ad?*

- Req2: *Who has targeted me with this ad?*

- Req3: *How (through what processes and decisions) have I been targeted with this ad?*

The general requirement asked in this section only focus on the *display* of an ad, and not Alice's '*conversion.*' Thus, for the remainder of the processes and conceptualising the model, I only focus on the first part of the scenario.

7.1.4   Abstraction

The next step involves abstraction of key operational details to be able to analyse the system, determine what data should be included, and identify dependencies necessary for addressing these requirements. The following sections abstract the actors, their environment and the interactions between them within the scenario, and outlines the assumptions. As mentioned in Chapter 6, the core activities in an OBTA life cycle were identified based on Big Data life cycle defined in a report by the Federal Trade Commission (Ramirez et al., 2016) and supplemented with activities identified from the sequence diagram in Section 7.1.4.3. Ramirez et al. (2016, pp.i) defines collection, compilation and consolidation, analysis, and use as the phases in Big Data life cycle. Building on this, more activities were then abstracted between these core activities to enable a more detailed breakdown of the processes involved. These abstractions were then used for identifying early requirements.

7.1.4.1   Actors

Based on the result of stakeholder analysis (Section 7.1.1), the scenario, and its defined user actions (Section 7.1.2), the following list comprises of the identified actors in the first part of the scenario. *Alice*, *UA* (User Agent), *P1* (Publisher), *AB*(Ad Broker), *AV* (Advertiser), *AS1* (*P1*'s ad server with *LAS1* as the local component on *domain1.com*, and *RAS* as the remote component on *ras.com*), *AS2* (AV's ad server with *LAS2* as the local component on *domain3.com* and *RAS* as the remote component on *ras.com*), *DMP1-4* providing external on/offline data to other actors in real time. In the following section, I describe the setting of the environment in which the scenario is situated.

7.1.4.2   Environment

- Local component of *AS1* is run by *P1*, resides on *P1*'s domain (*domain1.com*), and sets *P1* cookies. The remote component of *AS1* resides on *AS1*'s remote domain (*ras.com*) and sets *RAS* cookies *(id:RASuid)*.

- Local component of *AS2* is run by *AV*, resides on *AV*'s domain (*domain3.com*), and sets *AV* cookies. The remote component of *AS2* resides on *AS2*'s remote domain (*ras.com*) and sets *RAS* cookies *(id:RASuid)*.

- *P1*'s page embeds a web beacon (e.g. clear gif) that redirects *UA* to *AB*'s domain.

- *AV* is the winner of the RTB auction.

- *P1*, *AS1*, and *AS2* respect DNT but do not know whether the servers that host their resources (ad tag, hidden pixel, ad) on their page, will respect DNT or not. Therefore, they have a Tracking Status of *(?)* (Dynamic).

- *AB* has a tracking status of *T* (Tracking), suggesting that it is tracking.

- *AV* has a tracking status of *D* (Disregarding) which means that it disregards DNT and continues tracking.

- *AS1* and *AS2* have both distributed and remote components. The distributed servers are locally held by *P1* and *AV* respectively, and they collect, identify and analyse web users (meta)data for the domain that they reside on, and do not share this information with each other or the remote component. However, the remote component connects to a centralised database, and since the local component requires *UA* to pull resources from the remote, the remote will be informed of the page visit.

- The design decision for *P1* and *AV* to each have their own adservers was made as first-party ad servers may be used by OBTA actors due to its entitlement to first-party data (Stanleigh, 2014). Additionally, a variety of techniques were identified in previous studies through which third-party domains can set or interrogate first-party cookies (Krishnamurthy and Wills, 2009).

- Note on DNT Amongst previous interventions, the provisions of W3C DNT for communicating operational details is most relevant to the model. However, DNT does not provide provisions for communicating operational details on server-side interactions. This can be seen in Section 7.1.4.3 as informed by W3C (2016)'s report on DNT implementation. Tracking Status Resource (TSR) properties such as *config* and *controller* may be used to communicate details of the OBTA operations, but do not have provisions for communicating which parties OBTA actors may share the data with. Instead, the properties of TSR mainly point web users to the human readable privacy policies that as discussed earlier, are costly to read and impractical for web users.

7.1.4.3   Sequence of Interactions

Part one of the sequence of interactions between the agents in the OBTA scenario as defined in Section 7.1.2, has been visualised in Figure 7.6. Figure 7.6 illustrates the sequence of interactions between stakeholders in a hypothetical OBTA Scenario (including W3C tracking protection provisions); Scenario involves a user visiting a website and is targeted with a display behavioural ad; The OBTA practices include(but not limited to) RTB auction, cookie syncing, browser/device finger printing, psycho/demographic profiling.

The **Stakeholder key** consists of *Alice*: User; *UA*: UserAgent; *P*: Publisher; *AS1*: AdServer [**LAS:** Local AdServer (e.g. SSP: Supply Side Platform); **RAS**: Remote AdServer (e.g. Identity Management Platform)], *AB*: AdBroker; *AV*: Advertiser (e.g. retailor or their media agency), *AS2*: AdServer[**LAS**: Local AdServer (e.g. DSP: Demand Side Platform); **RAS**: Remote AdServer (e.g. Identity Management Platform)]; *DMP*: Data Management Platform/Data Broker.

Figure 7.2 represents a sequence diagram that illustrates the interactions from step 1-6 between actors in the first part of the scenario.

FIGURE 7.2:   Sequence Diagram of Scenario 7.1.2.1 (first 6 steps)

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1. *UA* sends an HTTP request to the web server that hosts *domain1.com*. As this is the first visit after emptying the cache, no cookie headers are sent in this request. As *Alice* has enabled DNT in her browser, a DNT:1 signal is included in this request.

2. Since the ad space in *P1*'s page is managed by an instance of *AS1*, *P1* runs a local instance of *AS1* on its own domain (*domain1.com*), called *LAS1*. Through *LAS1*, *P1* receives user info such as device, location, time, etc. It may also receive

external data from Data Management Platform (*DMP1*) about *Alice*, her user agent, or device, in which case it combines and integrates (e.g. cleans up conflicts or duplicates) all of this data and generates a unique id linking it with the URI in the referer header. This id is to be later embedded in a Set-Cookie header *(C1:P1uid)* which as time goes by can gradually become *Alice*'s browsing history log. Then *P1* stores all of this in its own database. Based on the content of the page from the referer and demographic information obtained from the request (e.g. IP address), device information, and the timing of the request, with the help of *LAS1*, *P1* infers demographics, and psychographics for this unique id. This information results into the production of a segment/vertical that is a more general taxonomy and web user psycho/demographics can be grouped to it.

3. *P1*'s Web server on *domain1.com* sends a HTTP response that contains a Set-Cookie header with the value of the id generated in the previous step *(C1:P1uid)*. This response also contains the content, and gives the formatting instructions. Furthermore, as *LAS1*'s operations rely on pulling resources from its central component on *ras.com*, this response includes URL to resources of the remote component of *AS1*. Additionally, as *P1* received the DNT:1 signal in the request sent in the previous step, this response may contain a tracking status value of TK (?:Dynamic) which shows that the data collected via the target resource might be used for tracking, and includes a status-id of *p1*. At this stage, *UA* can send a request to *www.domain1.com/.well-known/dnt/p1* in order to receive the Tracking Status Representation.[1] If *Alice* proceeds with this URI, the Tracking Status Object may appear as:

P1's *Tracking Status Object*

```
 {
   "tracking": "?",
   "controller": ["domain1.com"],
   "config":"domain1.com/p1Data"
}
```

4. For the ad space on *P1*'s page to be managed, the web server on *domain1.com* had instructed *UA* to redirect to *AS1*'s remote domain (*ras.com*) to pull resources from its remote components. Therefore, a request is sent from *UA* to *RAS*, and the same process as step 1 takes place.

5. Similar to step 2, *AS1* may collect certain information, compile it with external data (*DMP2*), consolidate them and assign a unique identifier *(RASuid)* to them.

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[1] Section 6.2.3 of the DNT expression specification states: 'A tracking status value of (?) means the origin server needs more information to determine tracking status, usually because the designated resource dynamically adjusts behaviour based on information in a request.'

6. Similar to step 3, *RAS* sends a response to *UA* that may contain *AS1*'s cookie (C2:RASuid). This response also contains a dynamic JavaScript tag that points *UA* to *AB*. As *AS1* has tracking Status of (?), the response will include a status-id of *as1* indicating to *www.ras.com/.well-known/dnt/as1*, which if proceeded with, may represent the following Tracking Status Object.

   AS1's Tracking Status Object

   ```
    {
      "tracking": "?",
      "controller": ["ras.com"],
      "config":"ras.com/as1Data"
    }
   ```

   Figure 7.3 represents a sequence diagram that illustrates the interactions from step 7-19 between actors in the first part of the scenario.

7. The ad tag sent in step 6 makes *UA* send a request to *AB*. Similar processes to step 1 take place. Additionally, this request contains the vertical associated with publisher's content. Vertical refers to a general category that describes the content of a web page, or an advertisement. Furthermore, this request may include a list of restrictions/exclusions for certain verticals, or categories of ads/ vendors/ attributes indicating publisher's intention to avoid displaying certain ads on their page (For more details see (Doubleclick, 2015)).

8. Similar to step 2, *AB* collects information, may combine and integrate external data (e.g.*DMP3*), infers interests, and infers segments and a profile. *AB* also receives a *DNT:1* signal and has a Tracking Status of *T* tracking.

9. *AB* sends a bid request (HTTP post) to advertisers in its network including *AV* that contains impression information and segments/verticals inferred in step 8, and any sensitive category, vendor, or attribute restriction that is declared by *P1* and advertisers need to be aware of for selecting their ads. Also, an encrypted version of *AB*'s unique identifier (encrypted *ABuid*), known as match tag will be associated with this data and included in the bid request.

   Figure 7.4 represents a sequence diagram that illustrates the interactions from step 20-22 between actors in the first part of the scenario.

10. *AV* receives this data, may compile it with other external data (e.g. *DMP4*), consolidates them and its bid engine analyses and uses this data for inferring the best ad and best price.

11. *AV* sends the bid response to *AB* and a HTML snippet of the ad that contains, along with its category, and other attributes that is needed for rendering the ad.
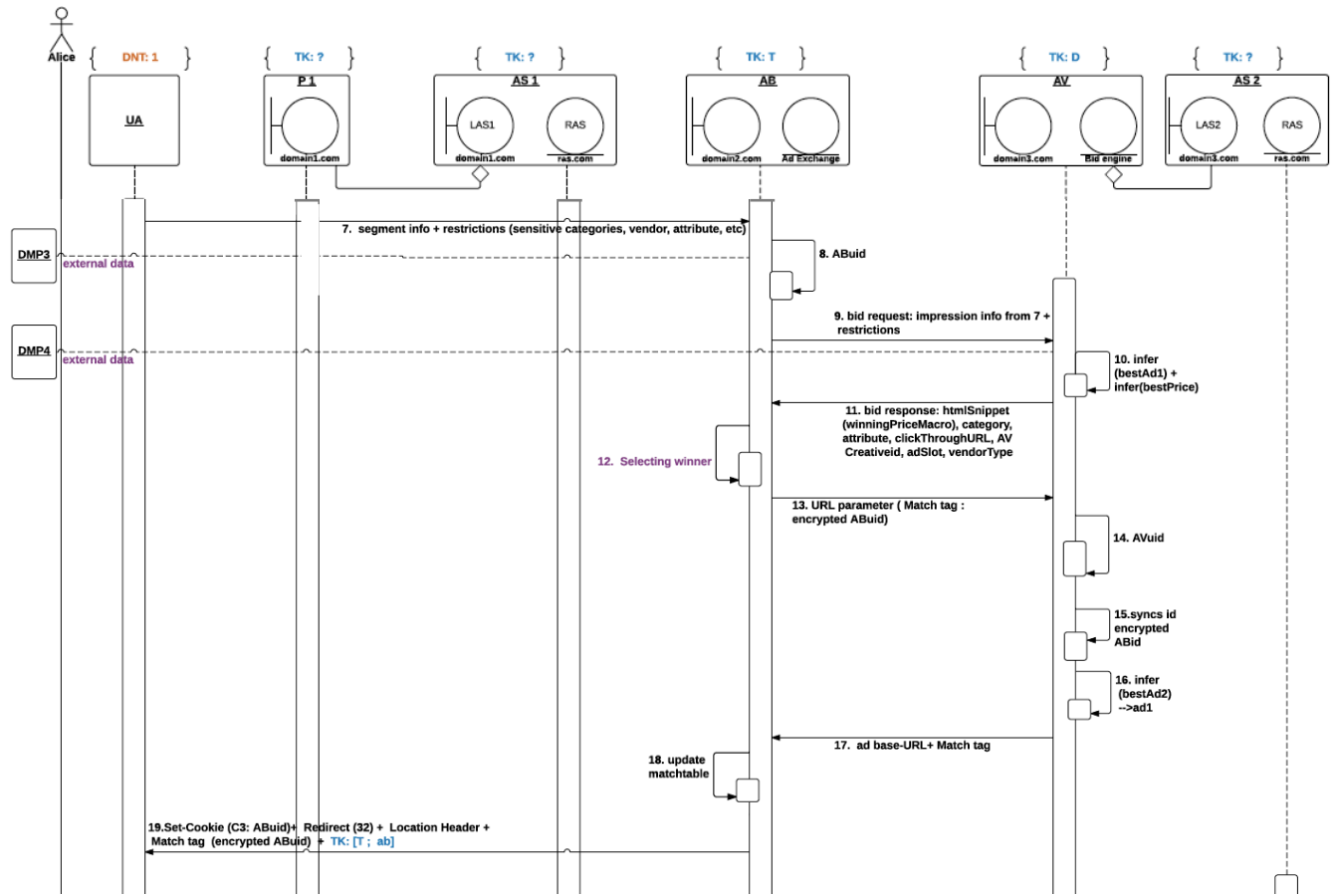
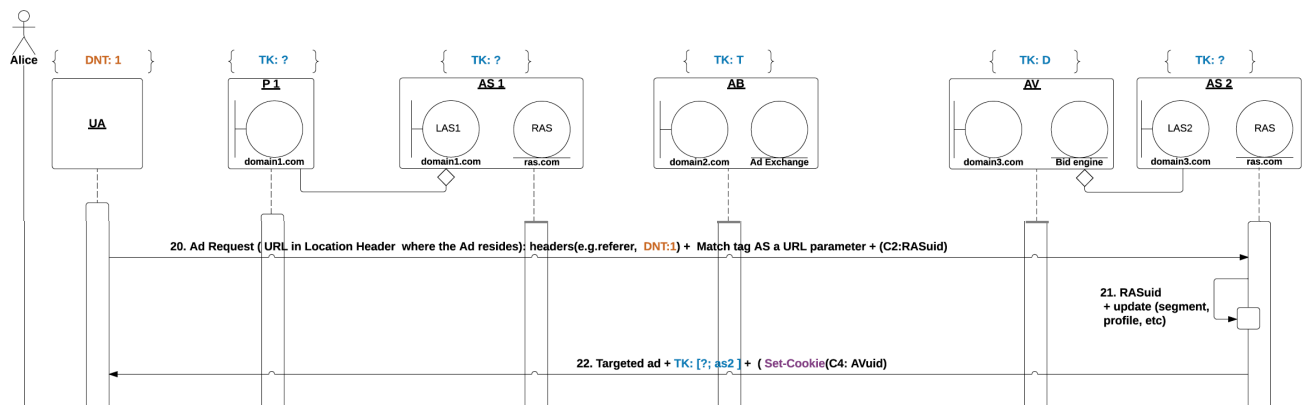FIGURE 7.3: Sequence Diagram of Scenario 7.1.2.1 (step 7-19)

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FIGURE 7.4: Sequence Diagram of Scenario 7.1.2.1 (steps 20-22)

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12. *AB* programmatically decides what bid combination(ad, price, extra info) in its inventory should win the auction. In this case *AV*'s bid wins the auction.

13. *AB* sends a request to *AV*. This request includes the match tag (encrypted *ABuid*) that was constructed in step 9 as a URL parameter.

14. *AV* receives the data sent by *AB*, compiles and consolidates it with previously gathered data in step 10 and assigns them to a unique id *(AVuid)*, and infers psychographics, segments and profile.

15. *AV* syncs the encrypted *ABuid* sent in step 9 with its newly generated id.

16. *AV* analyses all the available data to infer the best ad, and associate this ad with its id *(AVuid)*.

17. *AV* sends a response to the *AB* that contains the ad base URL and the match tag.

18. *AB* receives the match tag and updates its match table with new information such as the id, category and attributes of the selected ad.

19. *AB* sends a response to the user agent that contains a Set-Cookie header with C3: *ABuid*, and any sharing rules that specify which web servers on the domains legally owned by *AB* can access this information. The response also contains the match tag (from step 9 and a location header for redirecting the user agent to AVs ad server where the ad resides as informed by step 17. As *AB* has a Tracking Status of *T*, and the status-id of *ab* indicating that a Tracking Status Representation can be obtained by sending a valid GET request to *www.domain2.com/.well-known/dnt/ab*

    If *UA* sends a request to this URI, the Tracking Status Object may appear as:

    AB's Tracking Status Object

    ```
    {
      "tracking":"T",
      "controller": ["domain2.com"],
      "config":"domain2.com/abData"
    }
    ```

20. *UA* sends a request to *AS2* which is similar to 1. Additionally, the request may include the cookie *(C2:RASuid)* that was set in step 6. This is because both *P1* and *AV* are running ad servers with *RAS* as their remote component .

21. *AS2* receives the id from the cookie header and finds the previously stored data associated with it, updates this data with new data from the ad request in step 20. Additionally, the match tag enables associating a publisher's page (and the segment that describes its content) to the ad as well as the encrypted *ABuid*. After compilation and consolidation, *AS2* infers new segments and profiles.

22. *AS2* sends a response containing the ad. As *AS2* is locally installed on *AV*'s domain (domain3), it allows *AV* to send a Set-Cookie header *(C4:AVuid)*. Also, as *AS2* has a Tracking Status of (?), the response contains a status-id of *as2* indicating that a Tracking Status Representation can be obtained by sending a valid GET request to *www.domain3.com/.well-known/dnt/as2*

    If *UA* sends a request to this URI, the Tracking Status Object may appear as:

    AS2's Tracking Status Object

    ```
    {
      "tracking":"T",
      "controller": ["ras.com"],
      "config":"ras.com/as2Data"
    }
    ```

23. The user agent handles the ad and mark-up and the ad is displayed to *Alice*.

24. Once the ad is displayed, a web beacon in the ad that was embedded by *AV*, makes the user agent send a request to *AB*. This request will contain a cookie header (C3: *ABuid*) that was set in step 19.

    Figure 7.5 represents a sequence diagram that illustrates the interactions from step 23-27 between actors in the first part of the scenario.
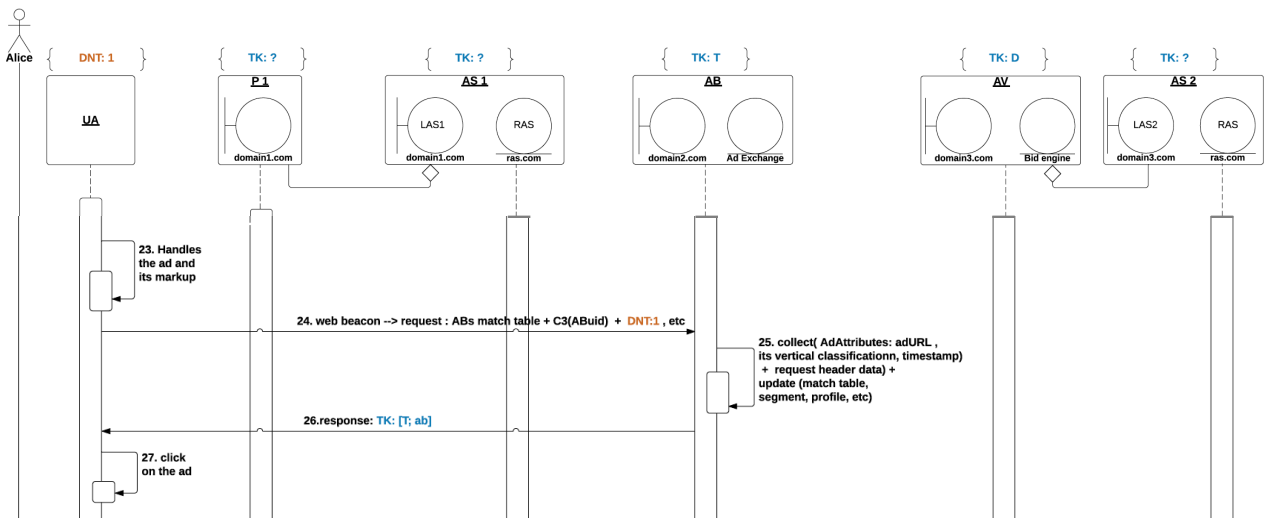

FIGURE 7.5: Sequence Diagram of Scenario 7.1.2.1 (step 23-27)

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25. *AB* receives this request, its match table looks up for the id sent in the request and updates its associated data with new data received from the displayed ad such as the ad id (which points to the ad's information), the publisher's id (which points to the content of the publisher's page and any segment that describes it), time of the day, etc.

26. *AB* sends a response back to the user agent.

27. *Alice* clicks on the ad (as defined in step 5 of scenario 7.1.2.

28. The user agent sends a request to *AV*'s page (retailer's online store). This request contains *AV*'s cookie *(C4:AVuid)*, the referer header, time, match tag, etc. informing *AV* that the ad is displayed to *Alice* from the publisher's website.

29. *AV* identifies the user from its database, syncs its *AVuid* with the match Tag, and updates its associated data with new data sent via the request and the click data.

30. *AV* sends a response back to the user agent. As the Tracking status of *AV* is *D*, this response will include a *TK: D* (Disregarding) and status-id of *av* indicating that the tracking representation resource can be found on *domain3.com/.well-known/dnt/av* where *AV* may point to the information in its privacy policy listing the specific reasons for not honouring *Alice*'s preference of DNT:1. If *UA* sends a request to this URI, the Tracking Status Representation may appear as:

    AV's Tracking Status Object

    ```
    {
      "tracking":"?",
        "controllers":["domain3.com"],
        "config":"domain3.com/avData"
    }
    ```

31. The conversion pixel placed in advertiser's page by *AV*, makes the user agent to send a request to *AB*. The request includes *AB*'s cookie *(C3:ABuid)*.

32. *AB* identifies *Alice* from its table, and updates its associated data with new conversion data that informs it about *Alice*'s visit to *AV*'s purchase page, plus any other data sent in the request headers.

33. *AB* sends a response back to *UA*. This is the end of part one.

Figure 7.6 represents a sequence diagram that illustrates the wider picture of the interactions between actors in the first part of the scenario. The descriptions of each step is included in what follows.
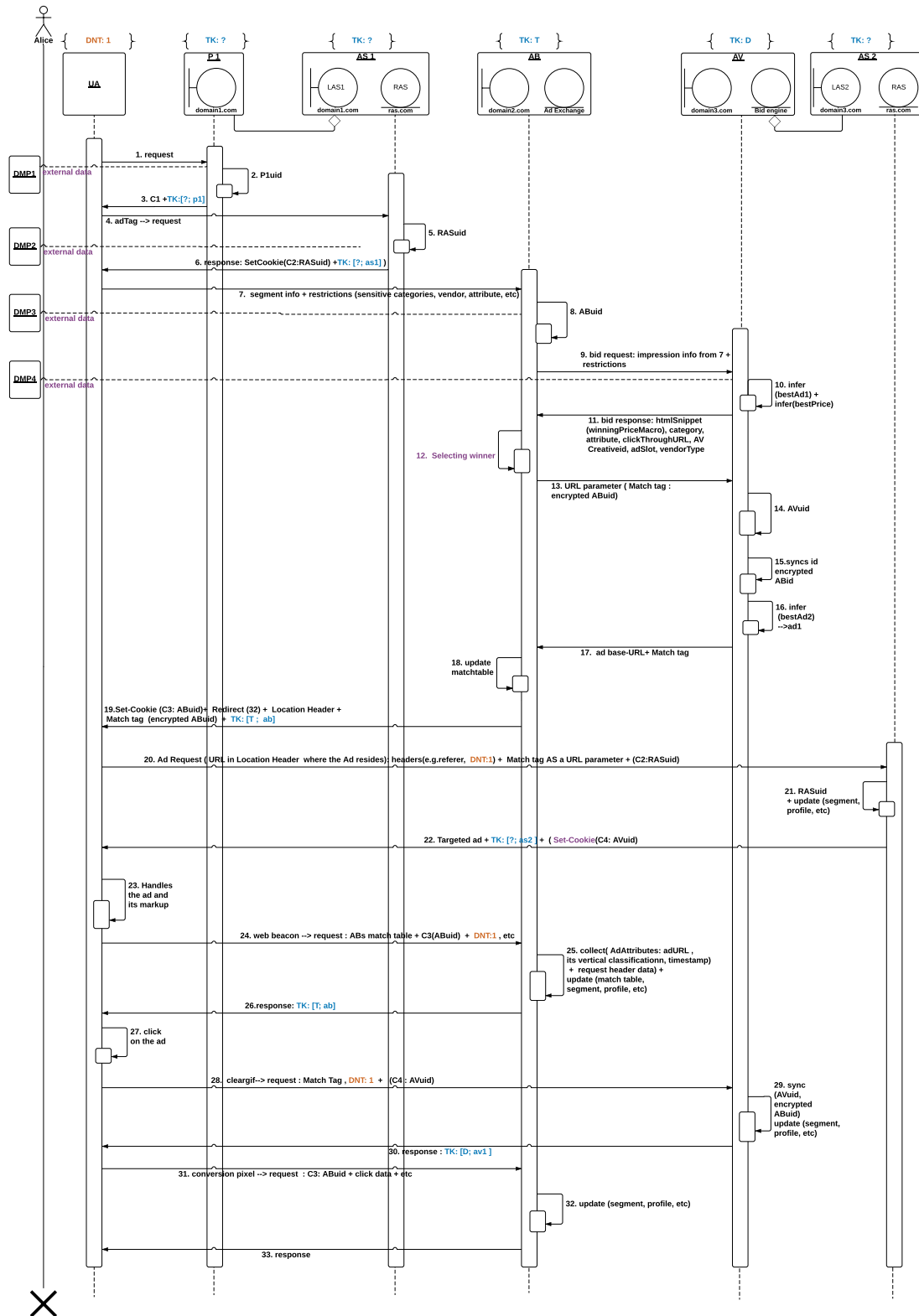
FIGURE 7.6:   Sequence Diagram of Scenario 7.1.2.1

7.1.4.4 Data flow- cookie sync

In Figure 7.6 the processes of cookie matching were simplified for readability. This section builds upon Englehardt (2014); Acar et al. (2014) and Google (e) amongst others,[2] to unpack these interactions, and illustrate how core activities can be abstracted from them. Figure 7.9 represents an information flow diagram, tracing Alice's data during the processes of cookie synchronisation.
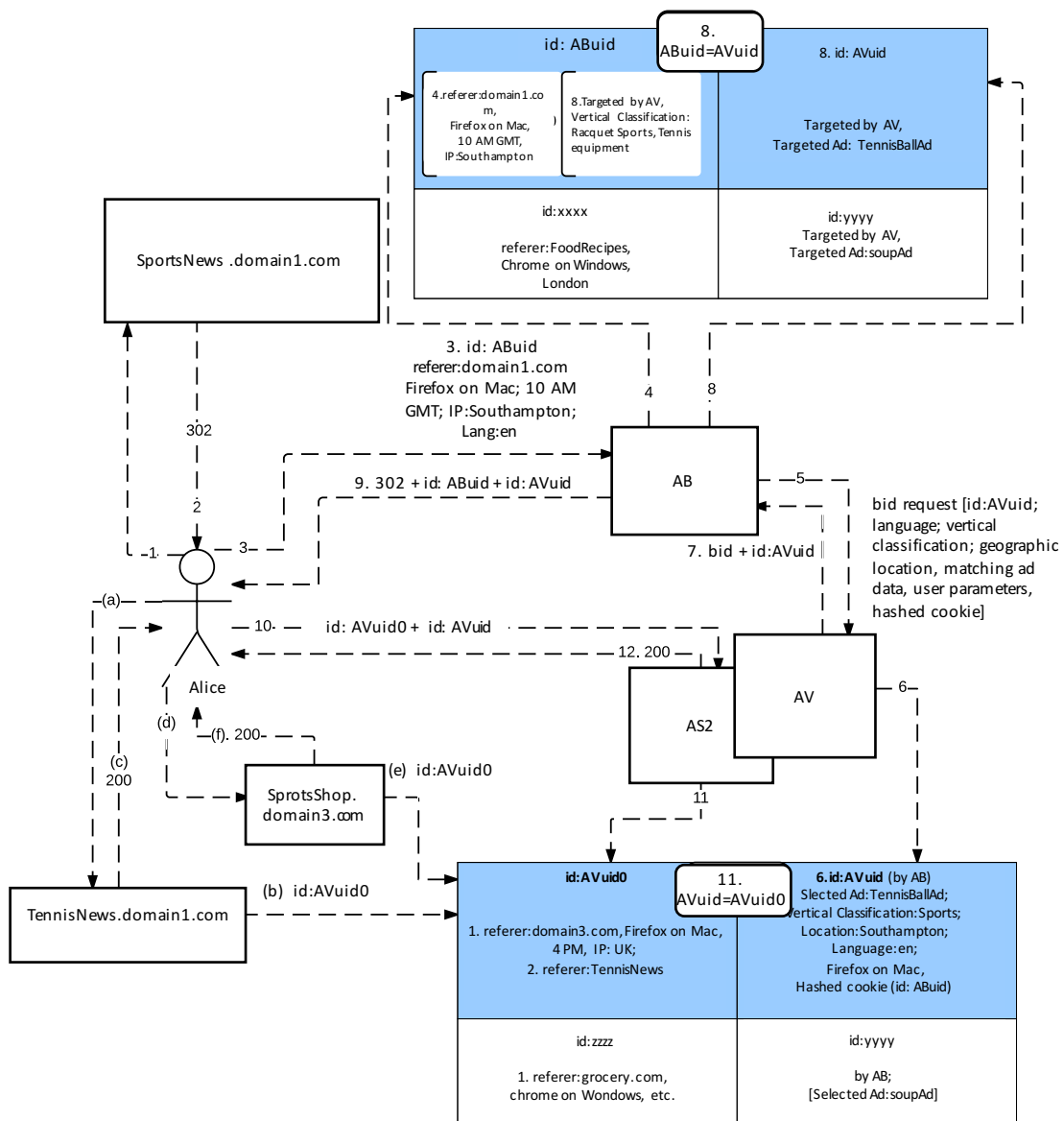
FIGURE 7.7: Data Flow Diagram of cookie syncing in an extended version of scenario 7.1.2.1 building upon Englehardt (2014); Acar et al. (2014) and Google (e).

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[2]For full details see Englehardt (2014).

The diagram highlights the flow of information in an extended version of scenario 7.1.2.1. To illustrate how Alice's information gets accumulated over time this scenario is extended to include:

(a) - (f): It is assumed that Alice's user agent already has a cookie with an AVuid0 set by AV/AS2 as a result of previously having visited TennisNews.domain1.com and sprotsShop.domain3.com.

Similar processes to the diagram in Figure 7.6 are conducted. As a result, the flow of Alice's data can be traced:

1-4 : Alice visits SportsNews.domain1.com and a cookie is Set by the AB (id:ABuid).

5-7 : As part of RTB bidding processes, AV stores the hashed cookie, vertical classification, user parameters, etc. by assigning it to an AVuid and storing it in its match table.

8-9 : The AB stores AV's AVuid into its match table and matches it to ABuid and sends a redirect to the browser.

10-12 : As part of the ad request with an AVuid, AV's own cookie previously constructed in (a)-(f) is passed to the AV/AS2, allowing it to match its own cookie with the hashed cookie(AVuid).

As a result of cookie synchronisation, and a bigger fraction of Alice's information can be accumulated by the ABs and the AVs over time.

7.1.5   Early Requirements

After abstracting and decomposing the hypothetical OBTA scenario, it is possible to revisit the general requirements outlined in Section 7.1.3. In what follows, it is explored how the complex questions asked in Section 7.1.3 can be broken down into smaller questions that are feasible to be met when translated through the new information provided by the abstraction and decomposition.

- **Req1.** *Which agents were involved in (micro)targeting Alice with the displayed ad?*

- **Req2.** *Which processes were involved in (micro)targeting Alice with the displayed ad?*

- **Req3.** *What profiles were made or updated by these agents in (micro)targeting Alice with the displayed ad?*

- **Req4.** *What data inputs and outputs were used use in (micro)targeting Alice with the displayed (micro)targeted ad?*

- **Req5.** *Which page visits has led to the display of the (micro)targeted ad?*

Answering these questions can provide a detailed picture of the entities, actor groups and processes involved in the incremental extraction, construction, or merging of *Alice*'s data. Development and implementation for meeting the requirements requires privacy and security considerations. However, since the framing for this design is speculative and the thesis does not intend to embark on implementation and development, it can be afforded to focus on other aspects of the design. Furthermore, the documented information can facilitate investigating the analytic and administrative processes and potentially gaps in compliance with DNT. This might be considered an example of 'accountability gaps' as defined in chapter 6. However, whether meeting this requirements can be qualified as indicating 'accountability gap' or measures for social corporate responsibility would require further research, that can be explored in the second part of the research when conducting key informant interviews for investigating the affordances of the model. This is detailed in what follows.

One way for *Alice* to obtain insights about the OBTA actors involved in delivering ads to her browser, is to measure OBTA companies' social corporate responsibility. Metrics that can indicate measures of social corporate responsibility here include, but are not limited to W3C DNT compliance check, and gaps indicating lack of communication of operational details by OBTA actors. Making a chain of DNT compliance records discoverable and gaps to represent parties that have not provided operational data, can potentially provide some insights about measuring social corporate responsibility. This requires providing answers to the following question.

- **Req6.** *Which agents indicate (non)compliance to DNT, what is their tracking status value upon receiving a DNT request, and where can their tracking status resource be obtained from?*

- **Req7.** *Which agents have not provided any operational details via TATE?*

7.2 Provenance

Chapter methodology justified the application of provenance in the conceptualisation of the model. As a reminder, provenance can be understood as

> '... a record that describes the people, institutions, entities, and activities, involved in producing, influencing, or delivering a piece of data or a thing in the world.' (Moreau et al., 2013b)

Provenance provides a means for annotating and documenting how a specific result has been derived, and enables identifying the processes involved in producing a particular output (Szomszor and Moreau, 2003, pp.604). This makes provenance very relevant to the discussions about transparency and accountability (Weitzner et al., 2008). For example, it can be used to analyse and document the processes that led to a data product, resources, or web documents across different applications and technologies (Moreau et al., 2013b) and for making trust assessments of information on the Web (De Nies et al., 2013).

7.2.1 PROV

PROV is a family of specifications developed by W3C Provenance Working Group that provides a core data model and vocabulary for interchanging provenance information (Moreau and Groth, 2013; Moreau et al., 2013a). PROV Data Model allows defining actors, activities and entities and the relationships between them. More specifically, it 'describes the use and production of entities by activities, which may be influenced in various ways by agents' (Moreau et al., 2013a). The core of PROV is structured into three classes and seven properties that are described by Moreau and Groth (2013, pp.21-22) as follows:

- '**Entities** (class prov:Entity) are digital artifacts or arbitrary things we want to describe the provenance of. The transfprmation and the flow of these entities is what we refer to as a *Derivation*, which is encoded by the property prov:wasDerivedFrom.'

- '**Activities** (class prov:Activity) take entities as input (it is the notion of *usage* described by the property prov:used) and output new entities (it is the notion of *Generation* described by the property prov:wasGeneratedBy). Furthermore, data may have flown from one activity to another, which is captured by the concept of *Communication*, expressed by prov:wasInformedBy.'

- '**Agent** (class prov:Agent) is the class of things found in the range of three properties. Agents may be responsible for (1) the existence of entities: that is what we call *Attribution*, which is expressed by prov:wasAttributedTo; (2) for past activities: that is *Association*, which is expressed by prov:wasAssociatedWith, or (3) for other agents: that constitutes a *Delegation*, encoded by prov:actedOnBehalfOf.'

Figure 7.8 is borrowed from Moreau and Groth (2013) that illustrates three different views, -the data flow view, the process flow view and the responsibility view -of the core of PROV using PROV's convention.
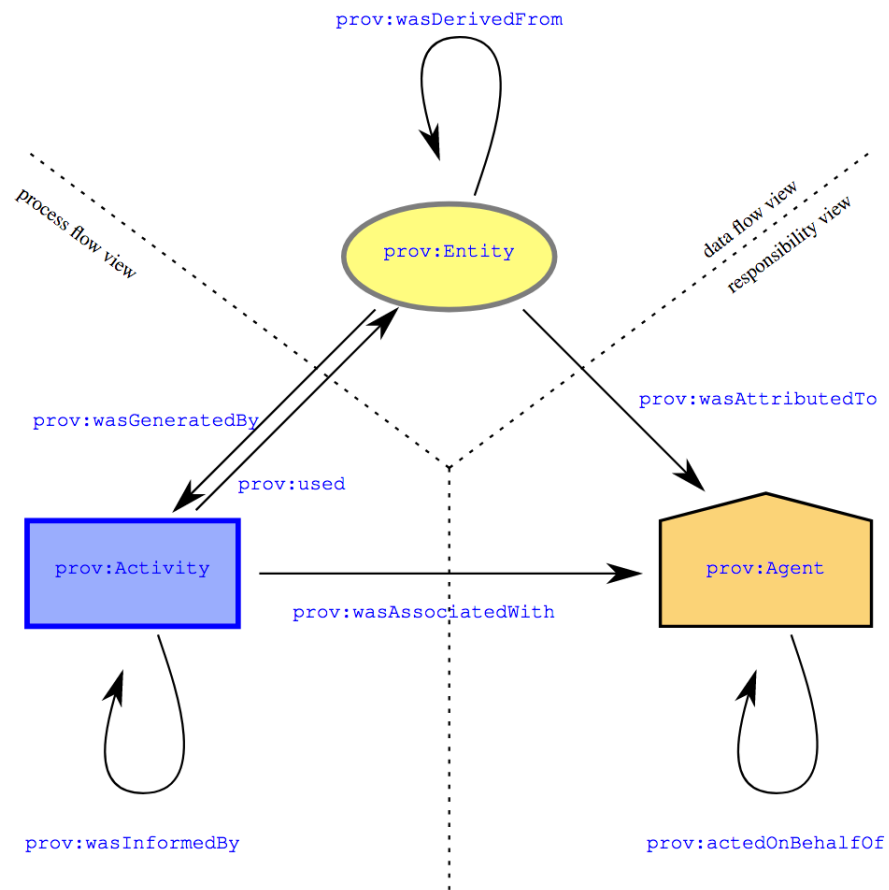
FIGURE 7.8: Three Different Views of the Core of PROV by Moreau and Groth (2013, pp.22-Figure 3.1).
'The figure adopts the PROV layout conventions: an entity is represented by a yellow ellipsis, an activity by a blue rectangle, and an agent by an orange pentagon. We note here that the diagram is a "class diagram "illustrating the classes that occur as domain and range of properties.' as quoted in Moreau and Groth (2013, pp.22-Figure 3.1).

The following UML diagram is borrowed from Moreau et al. (2013a) that illustrates the core structure of PROV.
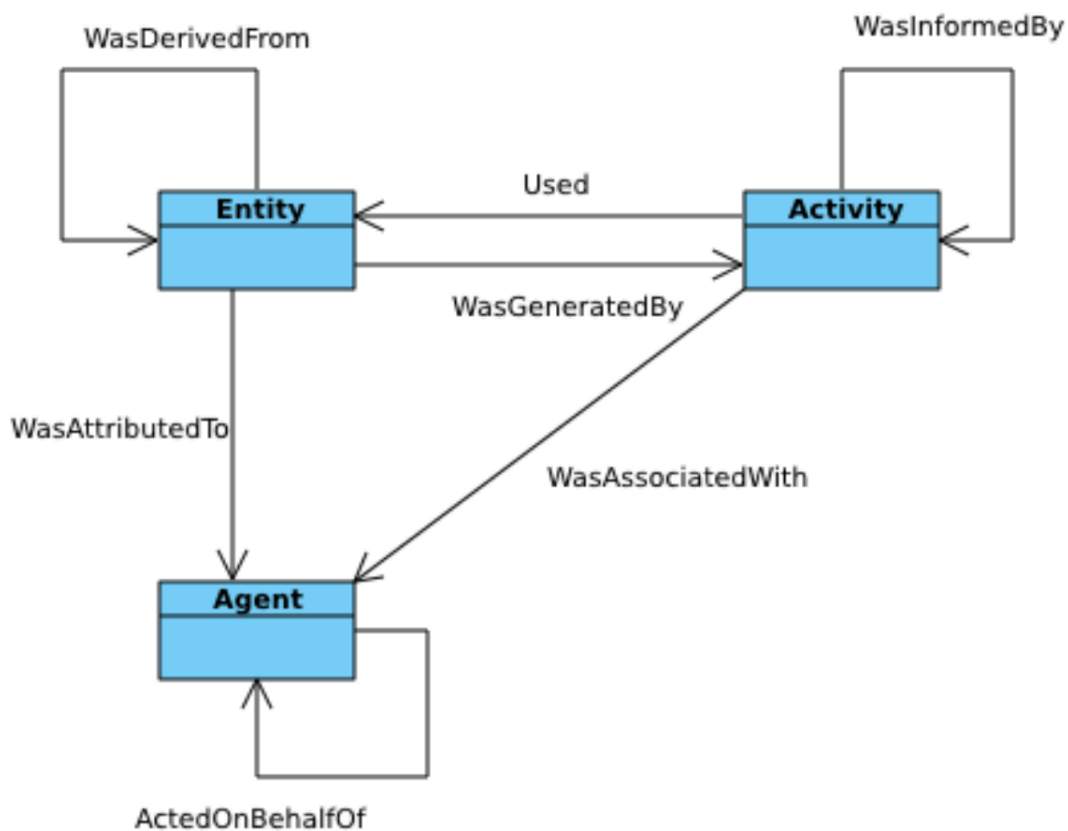
Figure 1◊: PROV Core Structures (Informative)

FIGURE 7.9:   A UML diagram of the Entity-Activity-Agent model from PROV stand-
ard Moreau et al. (2013a).

Providing PROV explanations in various stages of the OBTA mechanisms over time
can enable investigating the interplay of social and technical in OBTA. The following
sections describe how a lightweight ontology is formed based on the scenario that describe
the activity, entity, and agent types, in such way that the scenario can address the
requirements. A definition of an ontology by is presented in what follows.

'An ontology is an explicit specification of a conceptualization. The term
is borrowed from philosophy, where an ontology is a systematic account of
Existence. For knowledge-based systems, what "exists "is exactly that which
can be represented. When the knowledge of a domain is represented in a
declarative formalism, the set of objects that can be represented is called the
universe of discourse. This set of objects, and the describable relationships
among them, are reflected in the representational *vocabulary* with which a
knowledge-based program represents knowledge. Thus, we can describe the
ontology of a program by defining a set of representational terms. In such
an ontology, definitions associate the names of entities in the universe of

discourse (e.g., classes, relations, functions, or other objects) with human-readable text describing what the names are meant to denote, and formal axioms that constrain the interpretation and well-formed use of these terms.'
(Gruber, 1993, pp.199)

Conceptualising an ontology can provide a means for conceptualising the working domain of the OBTA ecosystem in a machine readable format. Using such ontological data model, user agents will be enabled to query and retrieve information about the activities, entities and actors that have led to or influenced the creation, or usage of a data product such as users' profile, cookie, or targeted ad.

7.2.2 Core types

The sequence diagram describing the scenario, and the identified questions require more details than the four broad Big Data phases mentioned in Ramirez et al. (2016). Therefore, these phases are extended, more detailed activity types are identified, and illustrated in such way that would enable accounting for the requirements. Going back to Figure 7.9 it can be illustrated how core activities can be abstracted from Alice's flow diagram during cookie syncing. Figure 7.10 relays core activities on Figure 7.9 to illustrates the processes involved in this abstraction during cookie syncing. Through similar processes, as illustrated in Figure 7.10, all core activities and entities are abstracted from the interactions in Figure 7.6.
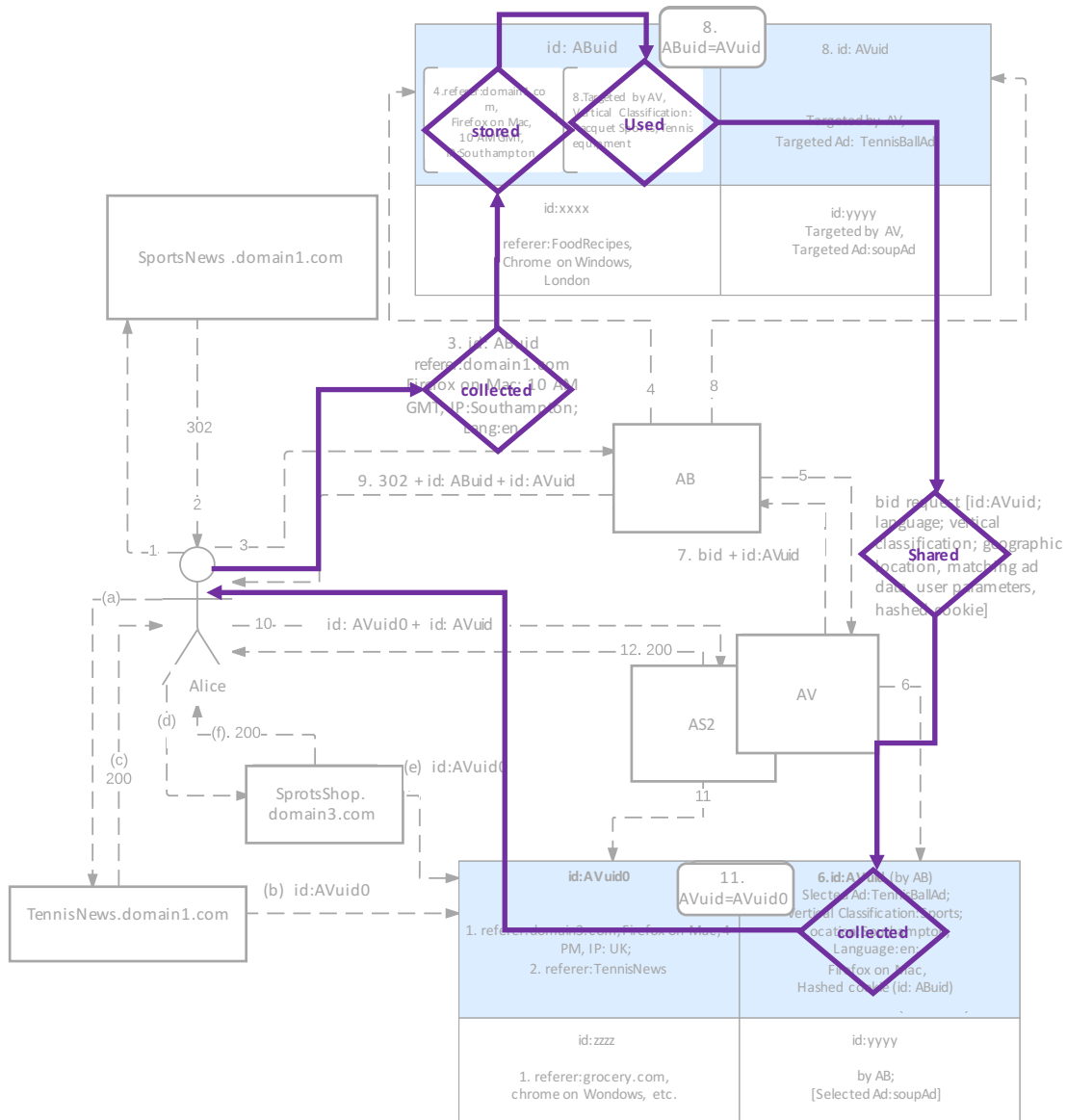
FIGURE 7.10: Abstracting core activities from Figure 7.9.

7.2.3   Representation in PROV

Guided by the the sequence diagram, actors, activities and entities were mapped to PROV's data model and a PROV document was constructed. Figure 7.11, 7.12 and Figure 7.13 show PROV graphs demonstrating the activities, entities and agents corresponding to step 24 and 25 of the sequence diagram. The model considers each activity as a black box, whilst making its inputs and outputs traceable in the the overall OBTA lifecycle. Queries can be customised to only retrieve generic information such as type of the inputs or outputs and not their values. This will allow auditing the OBTA mechanisms behind it in various stages. The following section provides specific examples of PROV graphs generated from the provenance notations representing the interactions in diagram 7.6, and exemplifies how repeating patterns can be represented as PROV templates.

Figure 7.11 represents provenance graph visualising activities, entities and agents involved in step 24 of the sequence diagram, and Figure 7.13 represents an instantiated provenance graph visualising activities, entities and agents involved in step 25 of the sequence diagram. Moreover, Entity *request7* itself is composed of other entities as illustrated in Figure 7.12. To detail this, Figure 7.12 illustrates a graph extending request7 from step 24 into its key components.
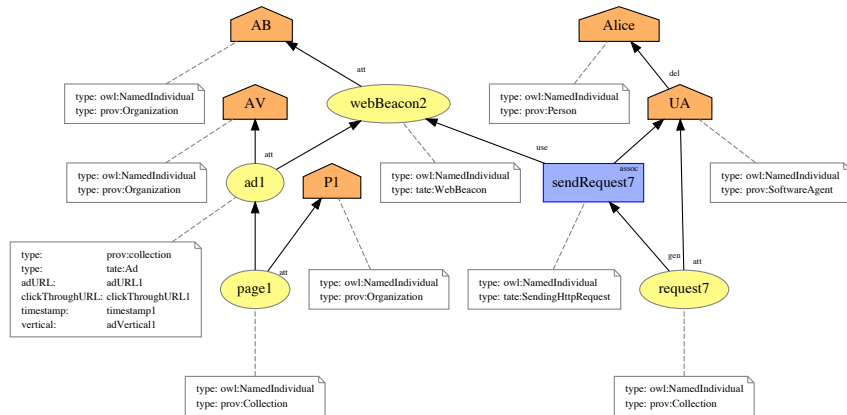
FIGURE 7.11: PROV graph of step 24 in Figure 7.6.
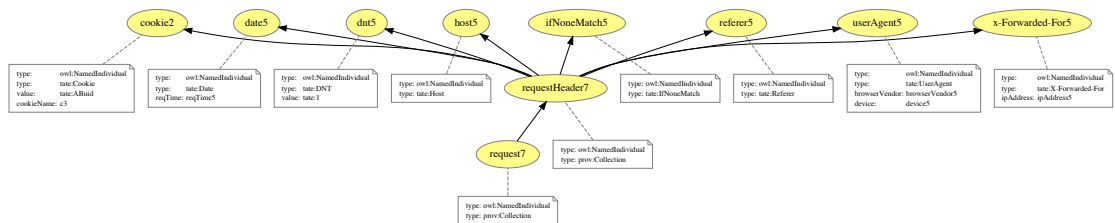
FIGURE 7.12: PROV graph extending entity 'Request' of step 24 in Figure 7.6.

From the generated graphs I identified some of the patterns and created their corresponding templates. Figure 7.14 represents a provenance template visualising the activity 'collect' and the data from an http request as its input. This graph is generated by

FIGURE 7.13: Instantiated PROV graph of step 25 in Figure 7.6

finding the patterns in collecting data from a http request as defined in the sequence
diagram in Section 7.6. Figure 7.15 is a graph generated from a template, visualising
the activities performed by the adBroker after having received an http request from the
user agent that does not include any cookie headers (similar to step 8 of the sequence
diagram in Section 7.1.4.3). Templates can be generated for each actor group, and be
adopted by that actor group as a standard way to provide operational details. TATE's
data model allows actors to identify themselves in more than one of the actor groups, in
which case they can use all of the relevant templates. When paired with their bindings,
these templates can represent instantiated sub-graphs from the scenario. The extracted
templates can be re-used with different bindings to represent other steps. The following
section exemplifies how requirements can be met via querying.

FIGURE 7.14: A Provenance graph visualising the activity 'collect' and the data from
an http request as its input.
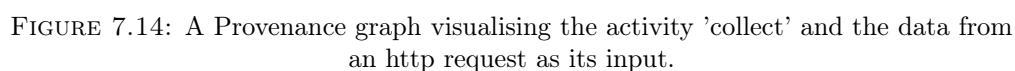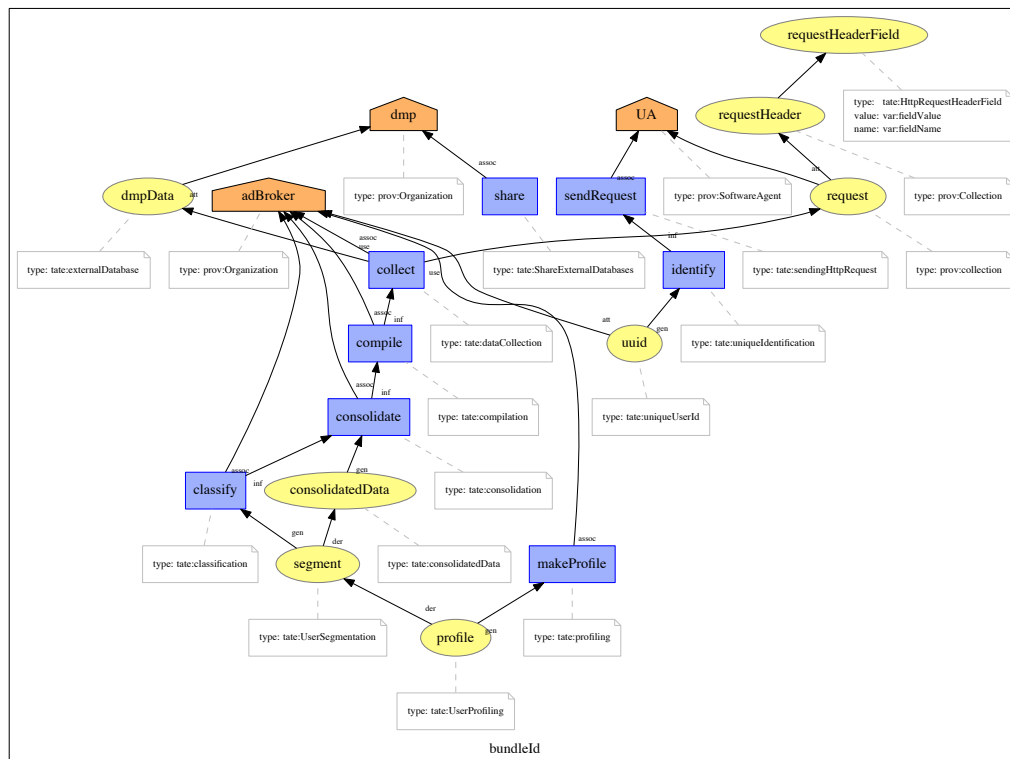
FIGURE 7.15: A sub-graph generated by a template and binding
The figure represents some of the activities performed by the adBroker actor group
after receiving an http request for the first time (ie.no cookies)

.

7.2.4 Validating Requirements

In req1 and req3, *Alice* asked which agents were involved in (micro)targeting her with the displayed ad, and what profiles were made or updated by these agents in the course of this targeting. The following query retrieves all different versions of profiles generated by different OBTA actors about Alice over time. Table 7.16 shows the results of this query. As illustrated in the results, some of the actors have generated different versions of profiles about Alice over time. The timestamp on these profiles enables sorting them to see the most recent profile, but also, having different versions of the profiles enables historical investigation on the changes made to the profiles over time. Table7.16 illustrates the results of query implementing the questions asked in requirements 1 and 3 as outlined in Section 7.1.5.

```
PREFIX tate: <http://provenance.ecs.soton.ac.uk/TATE#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
```

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX prov: <http://www.w3.org/ns/prov#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
SELECT ?profile ?agent
WHERE{
?profile prov:qualifiedAttribution [a tate:WasProfiledBy; prov:agent ?agent].}
```
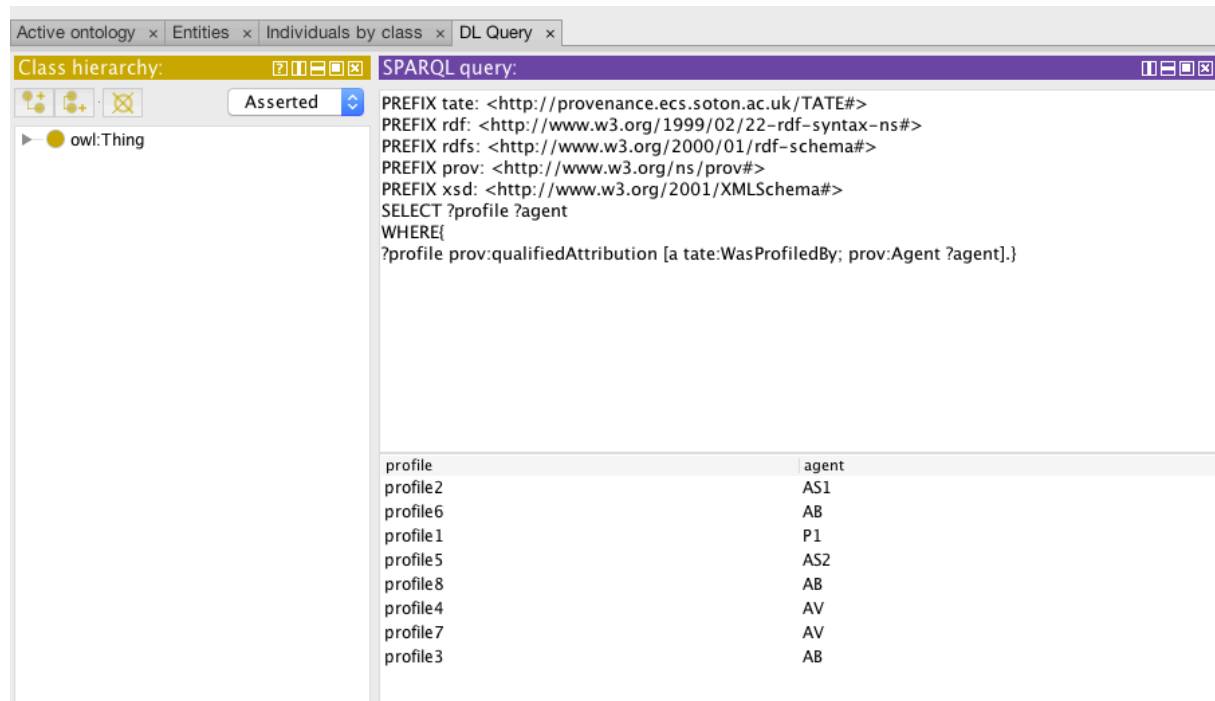

FIGURE 7.16:   Query and results validating Req 1 and 3.

In req6 *Alice* asked which OBTA agents indicate (non)compliance to DNT, what is their tracking status value upon receiving a DNT response and where can their tracking status resources be found. The following query implements the questions in this requirement.[3] If the server responds with a tracking status of 'D', this can be interpreted as non-compliance Doty et al. (2019). Therefore, the query retrieves tracking status value (TSV)s provided by agents via the 'Tk' response header field as well as the location where well-known resources that provide a machine-readable tracking status can be obtained. The results are presented in what follows. Table 7.17 illustrates the results of query implementing the question asked in req6 as outlined in Section 7.1.5.

```
SELECT ?agent ?tsv ?tk ?tsrUrl
WHERE{
?x prov:qualifiedAttribution [a tate:WasSentBy; prov:agent ?agent].
```

---

[3]prefixes are similar to the previous query and are omitted.

```
?x prov:hadMember [prov:hadMember ?tsv].
?tsv a tate:TSV; tate:TK ?tk.
?tsr prov:wasDerivedFrom ?tsv; prov:atLocation ?tsrUrl.}
```
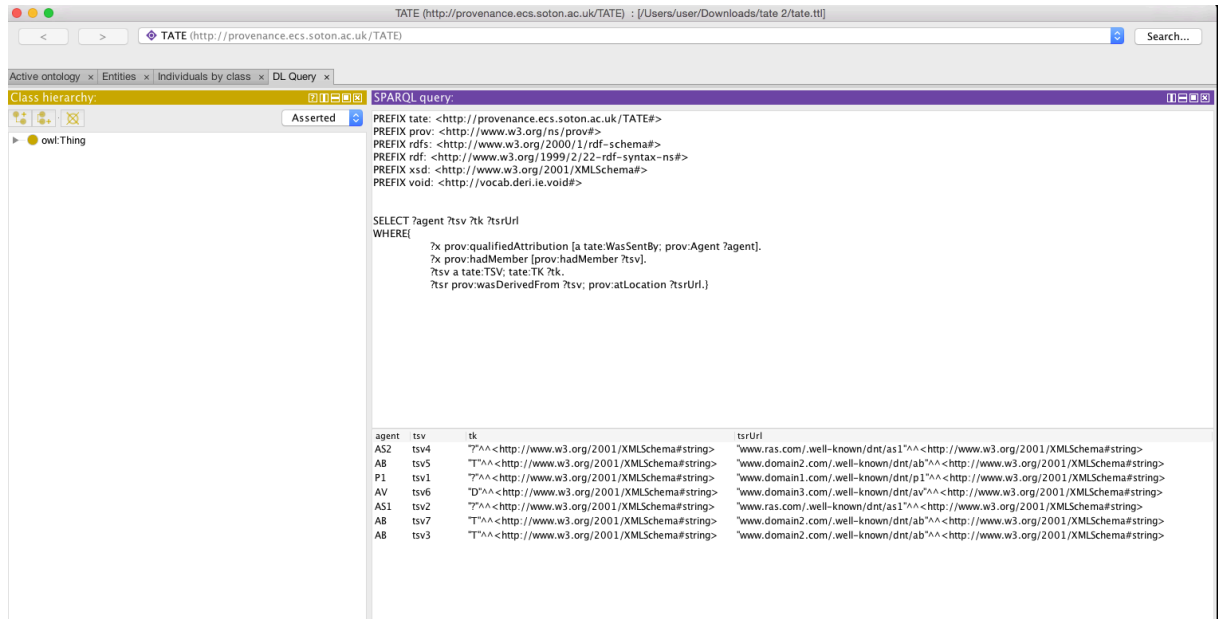

FIGURE 7.17:   Query and results validating Req 6-1.

As shown in this table, the OBTA agent *AV* has a tracking status value of D (Disregarding). Based on this, *Alice* (or *UA*) can retrieve DNT tracking status resources from the location indicated in the table to inspect reasons for this non-compliance, or the take actions regards future OBTA mechanisms conducted by *AV* on her browser.

The exemplified implemented queries here illustrate how both parts of requirements can be met. Table 7.16 illustrates how the context (e.g. data inputs/products, agents, etc.) of a targeted ad can be interrogated by *Alice*, and how agents can be differentiated based on measures of social responsibility. Similarly, other queries are implemented that validate the remaining of the requirements.

7.3   Speculating explanations

Chapter 6 described Alice as an imagined user of TATE to facilitate conceptualising the model, and therefore, in this chapter requirements were analysed from a Web-user's perspective. Here, a speculative design is provided to exemplify how the information derived from the queries could be presented to Alice. Figure 7.18 illustrates this example. Please note that words in colour indicate hyperlinks to the potential explanations resources.

FIGURE 7.18: Speculating basic explanations-web user level.

7.4   Conclusion

Previous chapter argued that devising mechanisms for algorithmic transparency that can support accountability is very challenging. There is currently a gap between calls for transparency and their responses within the domain of OBTA. ***How can the operational 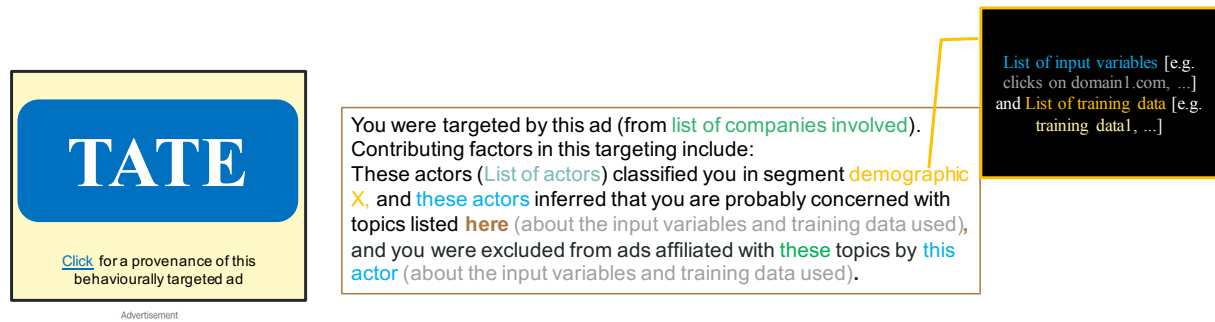details behind the analytic and administrative processes of OBTA be documented and communicated in an interoperable way across different actor groups?***

This chapter provided an answer for this research question within the framing of speculative design. A model for documenting and querying the provenance of analytic and administrative processes and decisions in the lifecycle of a targeted ad in an interoperable way across different actor groups was conceptualised that, was informed by requirement engineering methods within the framework of speculative design.

The conceptualised model in this chapter shows that within a speculative technical perspective, it is possible to communicate operational details. However, as described in Chapter 6, other requirements that fall outside of the framing of speculative design such as latency, scalability, etc. require further research within the conventional software development models. Here, the aim is not to create an operational artefact. Instead, the aim is to present TATE as a speculative design that is potentially controversial due to the level of transparency, to explore capacities and experiment with new forms of agency for enhancing transparency. Additionally, from a technical perspective, the speculative framing can be considered advantageous for knowledge elicitation. For example, the decision on who should be the imagined users and uses of TATE, is a sociotechnical inquiry that requires considering potential users (e.g. academic and journalistic researchers, web users, OBTA companies, regulatory and governance bodies). The speculative framing enables exploring if the requirements are contested, or misunderstood, and if and how perceptions about the concerns could vary. The conceptual model within the speculative framing enables engaging with stakeholders to analyse answers to these questions.

Conceptualizing the model involved managing complexity at multiple levels. This included developing an initial understanding of OBTA operations and environment, early stakeholder analysis, forming a hypothetical OBTA scenario including practices and technologies that raise consumer and industry concerns (e.g. cookie matching, browser/device fingerprinting, demo/psychographic profiling, Real Time Bidding auctions and programmatic advertising), abstraction, decomposition of the sequence of interactions between actor groups, early requirement analysis, modelling how operational details might be communicated in a way that can enable research, mapping the model into a standard (i.e. W3C PROV) for interoperability across different environments and technologies, and validating the requirements by running examples of SPARQL queries.

Questions remain on whether TATE could offer capacities for this and other imagined users and uses that would be investigated in the next stage of research when conducting key informant interviews. The informants include a wide range from consumer advocacy/ NGO, academics, governance and regulatory bodies, ad-tech companies, publishing industry, and more. The interviews aim to explore participants' speculations about TATE's affordances, and critically explore the acceptability and applicability of TATE for each actor group. As a result the following chapter asks if and how TATE *can be imagined to be used? and if so, by whom? and how? and what are its promises and challenges?*

Chapter 8

Speculations about TATE's affordances

In the previous chapter, a conceptual model for communicating operational details in OBTA, called TATE, was speculatively designed. The model aimed to enable documenting and querying the provenance of analytic and administrative processes in the lifecycle of a targeted ad in a way that can be used for enabling research. As detailed in chapter 6, following this, key informant interview was conducted. This chapter is concerned with the discussions that the model provoked when it was presented to the interview participants. In a broad sense, the questions asked in the interview were if TATE *can be imagined to be used? and if so, by whom? and how? and what are its promises and challenges?*

This chapter presents an analysis of participants speculations about TATE's affordances from the interviews. The discussions provoked by the above questions are used for exploring the affordances of the model for different actor groups; exploring some of the sociotechnical imaginaries that could shape our expectations about the future of OBTA; revisiting the requirements and adjusting/validating the model for its currently imagined user (Alice) and usage and analysing the capacities of TATE for other imagined uses and users. It is argued that this contributes to a sociotechnical understanding of OBTA, but also raises new questions that require further research as part of future work. The chapter ends by asking *how can a sociotechnical understanding of OBTA be used for sociotechnical future making for the Web?*

8.1 Overview

The on-going research of this thesis was communicated to the participants and questions were asked including, but not limited to, what was outlined in section 6.2.1.1, and 6.2.2.1.

Speculations about TATE's affordances have been very diverse *within* and *between* stakeholder groups. Based on the participants' speculations about TATE's affordances, two broad themes were generated from the interviews. The first theme reflects cases where participants could not imagine TATE to come to use for any users. In the second theme TATE was imagined to have different affordances, on different degrees, for different users and uses, some of which went beyond the initial imagined uses of TATE at its design stage.

Organising the analysis in what might appear as binary themes here, is not for the purpose of finding a binary answer to if TATE can afford an imagined use for an imagined user or not. As described in chapter 6, inspired by Davis and Chouinard (2016) and Nagy and Neff (2015) amongst others, in this thesis affordances are considered as a non-binary concept, and the aim is to look for degrees of affordances for imagined uses and users. What is categorized in the first theme are less nuanced, and hence, they are separated from the second theme where speculations are more nuanced:

In the second theme, there is often an emphasis on *when* and *where* TATE might offer a capacity, to what extent the stakeholders would have agency to leverage this capacity, and what factors from the underlying context limits and conditions this agency. Meanwhile, lack of nuance about TATE's affordances in the first theme, does not lessen the value of the data from this theme to justify excluding them from the analysis: Alternatives to TATE are imagined for stepping towards addressing the concerns surrounding OBTA in some cases, that, provide valuable information about the current state of OBTA, and some of the sociotechnical imaginaries that might be shaping expectations about the future.

Therefore, the approach to analyzing speculations about TATE's affordances is not solely about TATE's affordances, but how these affordances intersect with the wider context that the actor groups are situated in. This includes the agential capacities of stakeholders for enhancing transparency, the incentive structure, and/or desire, and/or ability for taking steps from the current state towards enhancing transparency. As a result, the concept of affordances is used for thinking about structure and agency in a non-binary way. As an analytical lens for exploring TATE's agential capacities and limitations, this can provide insight about the dynamics of the OBTA ecosystem, its organisational structure, and the underlying social, political, economic, and cultural context, that is needed for developing a sociotechnical understanding of the current state of OBTA.

In addition to these two broad themes, the model's quality of design and features are explored within the framing of speculative design to analyze the model's affordances from a technical point of view where this has been part of the conversation in the interviews with an aim to contribute to a late requirement analysis. Often these conversations have been limited to interviews where participants had technical backgrounds. In some cases, adjustment were recommended that are outlined and described. Furthermore,

the analysis of speculations about TATE's affordances includes analysing stakeholders' perceptions about the concerns and underlying assumptions.

As a result, in summary, the analysis is presented in four broad sections: In the first section, some of the key findings from perceptions of concerns surrounding OBTA are discussed by providing empirical data from the interviews. The second section focuses on cases where participants have perceived no affordances for TATE, including cases there were speculations about alternative sociotechnical imaginaries, and discuss them. The third section focuses on cases where different degrees of affordances for different user groups (individuals/researchers, companies, and governance bodies) is speculated. Lastly, the fourth section, describes what is gathered about the quality of TATE's features and design from the interviews where adjustments are recommended by the participants that enables revisiting the model.

The data presented in this chapter are qualitative, not statistically representative of stakeholder groups and are not generalizable, as the size of the sample is small, and opinions within and between stakeholders widely varies. Moreover, some of the participants emphasized that they speak only on a personal capacity and should not be considered representative of their companies. The approach to the interviews is situated and reflexive, and attempts to avoid claims to objectivity when presenting the analysis, based on an understanding that the researcher's own cultural, disciplinary, and social background shapes all stages of this research from data collection to transcription, interpretation and analysis. Finally, it should be considered that the themes generated and discussed in this chapter might not be considered representative as fixed views of the participants, as in some occasions, comments from the participants could be interpreted as contradictory, or inconsistent. In what follows, the analysis starts by unpacking different perceptions and degrees of concerns as discussed in the interviews.

8.2   Perceptions of the concerns surrounding OBTA

Perceptions of the consumer and industry concerns and questions surrounding OBTA widely varied *within* and *between* stakeholder groups and across different disciplines. In some cases, it was suggested that some of the concerns (e.g. privacy) are not shared by the public (p13-ad-tech; p18-governance and public policy). Some of the participants were not aware of the examples presented that raised critical questions, for example, about discrimination and exclusion (p13-adtech). Some validated the concerns surrounding OBTA such as discrimination, exclusion, etc., and/or discussed a desire for looking for best approaches to address them in a way that do not lead to other undesirable consequences (p1-ad-tech; p2-governance and public policy; p11-ad-tech). In what follows, an analytic account of some of the key discussions about the concerns surrounding OBTA and differences in perceptions of them are provided, and some of their underlying

assumptions are discussed. In some cases these assumptions are directly linked with speculations about TATE's affordances.

8.2.1   Framing the future

One of the participants suggested that OBTA do not raise serious concerns if solely used for advertising, but if their technologies and practices are used for purposes other than advertising they can cause concerns. They mentioned:

> '... there is a point where it is not just advertising, but it is almost near critical ubiquitous services, maybe including public services... then I think something flips the model of concern, and also the model of accountability and oversight....' (p18-governance and public policy)

As the interview progressed, the participant asked if the core of the concerns goes back to anxieties about 'uncanny valley,' a concept from psychology often used in robotics and animation to discuss the threshold of users' level of comfort with hyper-reality. They mentioned:

> ' Is this like an uncanny valley problem? The higher up question is either just to make it ever better, or to try and stop it happening... What's the top level objective that we might have in that space? ...That feels to me the bigger philosophical and political question that I don't know what to think about it myself. But it just strikes me that as a human I feel that the problem with this world comes where it is clumsy, and is even denying people opportunities, or is mis-guessing... But then actually, fast-forward this to seven years and the machine is not just better than Bob, but is actually, mega-amazing at this. Do we just ...? I don't know, it's not as straight forward as this...' (p18-governance and public policy)

The assumption that if OBTA are only used for advertising are benign, is refutable. Chapter 4 provided examples where sometimes ads can exclude (from offers, discounts, products, etc.) and/or lead to discrimination and privacy harms. However, (p18)'s question on the desirability of a hyper-efficient future is very important, and requires sociotechnical imagination in looking for answers. Meanwhile, the above quote also raises questions about the potential underlying assumptions, whereby, the concerns about discrimination and exclusion, are perceived as merely engineering errors. This assumptions has consequences for both the present thinking about OBTA and its future. As for the former, concerns surrounding OBTA are perceived as technical errors, dismissing both the concerns about the social practices, and the contingencies rising from both social and

technical. In relation to the future, this assumption can shape expectations about the future. As a result, the possibility of the future is framed in binary options: one option to embrace technology, and the other to refuse it, with no other alternatives.

However, this thesis has been positioned against such assumption, and through various theories and concepts, such as co-production and affordances, it has been argued that a sociotechnical approach, capable of accounting for control and contingencies, and considering both structure and agency is needed for both understanding the concerns, and addressing them. This can avoid an all or nothing narrative, and consider degrees of agency that might be limited or conditioned by the underlying social, cultural, economic, or political context. Meanwhile, others did not have such assumption. For instance, in relation to the concerns surrounding OBTA, one of the participants suggested:

> '... it's just a very simple model of how to target adverts to people. I wasn't au fait with the Google example with higher paid job ads being advertised to males more than females. But I can imagine how that very easily could occur. You know if that advert was just retargeted to users that had visited a certain page, then whatever your sample group is on this page, is who goes on to see it. So, if it was 80% males 20% females, then you would expect the adverts to get served to 80% male and 20% females. I don't know if... Well it is a big moral question. Isn't it? I don't know if that is discriminatory or sexist or anything else. But it's just a very simple model of how to target adverts to people. And quite a lot of what happens on the web is fairly simplistic. You came to this page therefore we are going to put you in ABC groups...' (p13-adtech)

(p13) points to a particular affordances of retargeting technologies, that is about consistency in mirroring what they have been trained on. Concerns are not perceived as technical errors that can be fixed with technical solutions, but at the same time, the problem is not seen inherent to the technology, as they also point to the social practices that highlight the significance of when and where retargeting is used.

As discussed in chapter 4, whilst the consistency provided by algorithmic matching/decision making can be desirable in many cases, it can also be undesirable in other cases. For example, when it can result in mirroring and amplifying existing inequalities. This emphasizes the importance of the decisions, which hints to degrees of agency, whilst not dismissing the possibility of contingencies that might limit this agency. As a result, concerns may rise from the affordances of retargeting technologies as they intersect with different social contexts.

Some of the participants including technologists working in OBTA industries shared the concerns, and the desire for finding best approaches to addressing them. Meanwhile, a

participant explained a potential underlying assumption that sometimes, contributes to perceptions of the ability to address the concerns. They said:

> '...I think because people don't really know... you just get people falling into one of the two camps of it's all your fault, or there is nothing we can do about. And so the fact that there is something that you can do about it to try and understand what is happening, would be interesting and even just highlighting typical examples of who's got what, the companies have got what data, and stuff... ' (p4-industry researcher)

This shows how the underlying assumptions behind the cause of the concerns can enhance or limit agency in addressing them. Perceiving the concerns surrounding OBTA as technical errors, or putting too much emphasis on theories of control, whilst dismissing theories of contingency, can lead to a sense of collective defeatism. Thinking about concerns and critical questions, therefore, requires finding a middle ground between technological deterministic (problems are inherent to technologies) or socially constructivist (technologies are neutral) assumptions. Being aware of the current underlying assumptions in thinking about the concerns, can open the possibilities of the future, even-though these possibilities are not unlimited.

8.2.2   Overlaps and gaps in consumer and industry concerns

Another key point from the analysis of participants' perceptions of concerns surrounding OBTA is that whilst the lines between industry and consumer concerns are increasingly blurring, yet there is a gap between industry's and consumer's perception of concerns. For example, one of the participants mentioned:

> '...in a B2B space, I think you absolutely have to look for reputation and ethics, of course you do. And I think between B2B and B2C there is probably more similarities than there are differences.'... 'The decisions to do business -whether you are a single customer, or you are a business-is still a person at the end of the day.'(p6-Industry researcher)

The above quotes confirm the argument made earlier about agency, whilst adding a new point that the lines between industry and consumer concerns are increasingly blurring. Meanwhile, another participant noted:

> '...discrimination is clearly a problem for consumers, and the mechanisms by which this work, you have illustrated well. So things like postcode, that sort of thing. Now, the real issues for business, come when you are making

decisions that actually have a material cost to the end recipients. For the most of the things we do, most of online advertising is much more low-level. We are not targeting opportunities to just white middle-class males. We tend to be advertising the wrong product to the wrong group....' (p1-adtech)

The above quote re-emphasizes that concerns about targeted advertising depend on when and where they are used, and what type of targeting is used. As described in chapter 3, in many cases online advertising do not raise concerns, whilst sustaining the production and maintenance of online content and services. The above quote also raises important questions in relation to the harms-based approach to privacy and data protection. As part of introducing this model in chapter 4, Crawford (2017)'s distinction of allocative vs representational harm was outlined, where, the former results in measurable economic loss (such as losing a job), whereas the latter is about harmful representation of an individual's or a community's identity. This re-emphasizes the first point and the importance of when and where OBTA are used, and the different types of OBTA, even more. But at the same time, suggests there is currently a gap in the perception of concerns between consumer and industry perspective, which is in relation to harms that are not easily measurable.

Therefore, as illustrated in this section, perceptions of the consumer and industry concerns and questions surrounding OBTA widely varied *within* and *between* stakeholder groups and across different disciplines. A key sub-theme generated from the perceptions of the concerns surrounding OBTA is a binary framing of the present and the future. A key finding is that there are some overlaps, and gaps between industry and consumer concerns.

In what follows, the analysis is presented based on the two themes generated as mentioned in section 8.1, as opposed to stakeholder groups, or disciplines.

8.3   No affordances

This section reflects key discussions where TATE could not be imagined to come to use, with no, or low flexibility, and/or nuance. In some cases, there was a desire for intervention, but TATE specifically was not considered feasible for business (p11-ad-tech), or legal reasons (p8-Industry researcher), and its advantages were considered not able to outweigh its disadvantages (p13-adtech; p8-Industry researcher), and alternative interventions such as returning to self-regulatory initiatives like ad-choices were speculated (p13-adtech). For some, this had ties with perceptions of the concerns and their degrees (p13-adtech). Occasionally, this was part of a wider argument against any type of intervention and change. In some cases, alternative sociotechnical imaginaries were put forward for addressing concerns surrounding OBTA, such as new disruptive technologies,

or more data collection that would lead to better targeting. In what follows, examples of these are provided and discussed.

Some of the participants argued that the main idea behind TATE would not be feasible, from a business (p11-ad-tech), or legal (p8-Industry researcher) point of view. In some cases, this was directly linked with assumptions about the state of public perception of the concerns surrounding OBTA. For example, one of the participants suggested.

> 'I don't think we have ever come across someone who is so upset by an advert that they have got in contact with us to make us aware of it. So, I don't know how big of need this auditable stream of everything that ever happens on the Internet is. Because it will be a lot of cost for I guess what benefit...? I don't know enough about that. Or what value that someone is going to put on that benefit.' (p13-ad tech)

The point about cost of adoption is an important part of the discussion about TATE, that requires research outside the framework of speculative design. If the costs of adoption are too high, then, this could cause new financial burdens to smaller companies that might not be able to afford such costs. Therefore, thinking about implementation and development should consider optimising for low/no costs to adoption. However, (p13)'s speculations in relation to cost, did not consider the possibility of optimising for low cost, and lacked flexibility and nuance. Instead, they advocated returning to self-regulatory initiatives such as ad-choices. However, as discussed in chapter 5, ad-choices and other self-regulatory initiatives have so far come with usability flaws, and in some occasions, lack of enforcement/redress mechanism has abstained them from fulfilling their potential. This point was mentioned during the interviews (p20-publishing industry).

Another participant made a similar point about lack of public concerns to argue lack of justification for intervention:

> '... I don't detect a very big public concern about this...there is not a great clamour from the public. So, I bought a pair of shoes, and now it has started tracking me around the Internet, because of the shoes that I already bought. It's fine. It's not a big deal... Even though there has been a massive shift, and there is quite a lot of public awareness about tracking because of the cookie law. But I don't detect and I don't remember seeing any empirical evidence, or even deep focus-group evidence on whether people are actually really freaked out by this.' (p18-governance and public policy)

The notion that users are not concerned about privacy is disputable. As noted in chapter 4 studies show that users have privacy concerns (King et al., 2011; Balebako et al., 2013; Bilogrevic and Ortlieb, 2016). Meanwhile, this participant suggested that the market is

currently not mature enough to handle policy interventions. But speculated that, at a later time, for the wider domain of algorithmic decision making, regular auditing visits from an independent body, along with transparency mechanisms can be a step towards addressing the concerns (p18-governance and public policy).

As suggested in chapter 4 in addition to privacy concerns, a major part of concerns surrounding OBTA is where and when they are used. Whilst it is possible that OBTA are practiced in benign ways for sustaining the revenue needed for production of online content and services, there are also problematic practices, and contingencies that can lead to undesirable outcomes. Chapter 5 argued that fiduciary obligations and safeguards are needed for problematic data collection and usage, as expecting individuals to be sole responsible for managing, protecting, and maintaining the protection and usage of their data and privacy, is not realistic and practical. In addition to these obligations and safeguards, interventions for transparency are needed to make the issues visible and enable public scrutiny, as ads are ephemeral and problematic ads can only be visible to those that are targeted with them. Enforceable standards for communication of operational details instead are therefore needed in addition to obligations and safeguards.

Furthermore, large scale research on public concerns about OBTA is currently lacking, and therefore, it is challenging to determine the state of public concerns. However, whilst determining a causal relationship would be difficult, a potential indicator for concerns is decline of public trust in OBTA that was discussed in chapter 4. It was also argued that systematic communication of operational details can help re-building trust. Therefore, the case for transparency can help investigating both consumer and industry concerns.

Despite all of this, in some cases where concerns were shared, alternative sociotechnical imaginaries were speculated instead of the combination of data protection, safeguards, and transparency for addressing the concerns. For example, one of the participants noted:

> '...the way the industry needs to address this is twofold. The first thing is you really need more granular data. The more data you have, then the better you can target. So, when a company does some sort of manual targeting, they will get a list of most affluent postcodes and they target directly to those. But along with that, businesses also need to increasingly put in place mechanisms that prevent discrimination.'(p1-adtech)

The above quote embeds two different messages. One a need for more data for better targeting as a partial means for addressing the concerns, and then complementing this with safeguards. However, the point about the need for better targeting by more data collection can be problematized, as it goes back to underlying assumptions as stated in the previous section about perceiving problems as purely technical errors.

In addition to the above imaginary, another sociotechnical imaginary was speculated: new disruptive technological innovation to provide control and ownership over personal data. One of the participants mentioned:

> ' ...Sorry this is a typical thing to quote -so you can't solve the problem with the same thinking that created it. That's a well-known phrase and I think that's where we are now. So I think all of the things that we see in ad-tech and mar-tech, and regulation, and all the rest of it is all symptomatic. And whatever that comes along, is going to be a destroyer. It's not even good or bad, just would be a destroyer, and it would make that old thing pointless... The way that this thing interacts with the existing system neutralises the negative aspects, whatever we have perceived them to be. But I think it generally causes friction and moral hazard within the system and just neutralises it, and makes it irrelevant, and almost resets it in a way that I think would be so disruptive. Almost to the point where it scares me thinking about it, because of the anarchy that can follow as a result... so many vested interests could be disrupted: I don't see any reason at all why you wouldn't suck all of social capital out of platformABC and put it all behind a firewall, and then say if you want it back, you have to come through my little API, and otherwise you can't get it.' (p-11-ad-tech)

This argument, to some extent follows a disruptive logic, that is often suggested to be a familiar model of thinking in the online advertising (Evans, 2009). However, change for the sake of change does not help moving towards addressing the concerns. Often technological disruptions transform existing problems into another, and create new problems. As it will be discussed later in this chapter, data from some of the participants suggests that the concentration of power in the OBTA market, contributes to limited agency for the smaller companies in taking steps towards transparency, even when there is a desire for this. However, the alternative sociotechnical imaginary speculated by (p11), eventually leads to replacing the current power concentration with another.

In addition to what has been discussed in this section, other speculations where TATE could not be imagined to come into use, were largely concerned with issues such as technical concerns about implementation, scalability, latency, security (access control) and privacy considerations that are not included as the model is designed within the framework of speculative design with the aim to prioritize sociotechnical research to technical considerations that might be able to be addressed at a later stage.

8.4 Speculations about TATE's affordances for imagined users and uses

The previous section discussed key themes where no affordances were imagined for TATE, and where alternative sociotechnical imaginaries were put forward instead. This section, details some of the more nuanced speculations about degrees of TATE's affordances for imagined users and uses. These cases were often centred around arguing that given certain conditions, TATE can offer some capacity. For example, TATE was imagined to be used from a public accountability (p20-publishing industry), business (p15-publishing industry), and governance and public policy (p25-academic) point of view. Fulfilling this capacity, would largely depend on degrees of stakeholders' agency in adopting and implementing TATE that might be impacted by the underlying conditions.

The scenarios for discussing TATE's affordances were in some cases built with the participants. This means that the source where these scenarios initiated from is not clear. Sometimes, they originated from myself or my supervisors, and sometimes, they originated from the participants. The source is therefore not the focus of this analysis. Instead, the focus centres on where TATE was speculated to have agential capacities. In what follows, speculations about TATE's affordances for imagined users and uses are discussed.

8.4.1 Individuals/researchers

Some of the participants speculated that given certain conditions, TATE offers a capacity on the consumer level. Conditions include having a user interface able to communicate clear and actionable information. There were various questions raised about the possibility of designing a user friendly interface capable of such communication (p7-industry researcher). Many emphasised that TATE's affordances on the web user level would also largely depend on how it is developed as a tool.

Amongst the imagined uses of TATE on an web user level, there was a scenario about incorporating a feedback mechanism for TATE, for enabling individuals to modify profiles, inferred interests, etc. and amending/editing them. In some cases, participants speculated a capacity for such imagined usage (p17-academic), whilst some warned about a false feeling of control that might rise from using such tool (p5-Industry researcher). In relation to the latter point, a participant suggested:

> '...So I am a great believer in being able to provide feedback. It gives you a feeling of being in control. But the real danger of that is that nothing happens, that's different... But yeah... just being able to say, you know, I'm not this. This is not correct, or I am not happy with this.' (p5-industry researcher)

It was discussed in chapter 5 that sometimes individualised transparency, can be a red herring, due to a tendency for using personal transparency rights as a replacement for safeguards. When these concerns were communicated, one of the participants suggested that if TATE was going to be used on an web user level, the typology of users would play an important part in answering whether or not it would be useful. They speculated a capacity for a small group of journalists, technologists, and enthusiasts. They said:

> 'it is sufficient that there is a tiny 2% of the population of users who are aware of this, monitor targeted advertising, and that in its own right is sufficient. Because then journalists get on the game ...and then journalists and so on inform comedians, who then on late-night comedy shows joke about all of this stuff. So the information gets disseminated in various adverse and disparate ways. And I think it is worth thinking about your TATE intervention in that sort of constellation of interventions. That ecology -If you like-of change and transformation in the world of Internet.' (p10-academic)

Whilst on an aggregate level this imagined use for particular users such as journalists and enthusiasts offers a capacity, yet there is a chance that this typology of users is not targeted with problematic ads that other groups of users might be targeted with. This means that for those targeted to be able to research such ads, they would also require sociotechnical research.

In addition to this, another imagined use for TATE on this level, was to only document the operational details on a more general level (e.g. segment, demographics, etc.), and disclose this data on an aggregate level by companies, to enable academic and journalistic research for public accountability purposes.

> 'I think that, that data is going to be useful only on aggregate... Where it gets interesting, is in that piece of research that you referred to, about more high-paid jobs ads being shown more to men than women. If this is the sort of framework that could provide transparency about the impact of algorithmic targeting more generally, by for example, providing a public interface that says that ads in this class were more frequently targeted to these demographics,... then there is real potential for social benefits, and that, providing transparency around political advertising during elections, for example. But that would require some of the really major players to buy into it, and get on board with it. And I guess to me that's kind of a really important feasibility question. If you can get Facebook and Google to buy into this, then fantastic. There will be a huge amount of data that can be mined out of it, and a lot of value in that. If Facebook's and Google's response to this is that we wouldn't get on board with that unless we are forced to,

then at that point, it's a difference between capturing 95% of the advertising industry or potentially only capturing 5%.' (p20-publishing industry)

On the one hand, documenting the data in an aggregate form, would mean focusing on targeted advertising as opposed to both targeted advertising and behavioural tracking. On the other hand, this can substantially reduce concerns about cost, privacy, security, etc. Currently studying ads, or the processes behind them is methodologically limited, and a costly and cumbersome process (Anstead et al., 2018). Currently ProPoublica maintains a public political ad archive that involves asking Facebook users to install a plug in that collects political ads. TATE's data combined with such archive can facilitate a rich source of data for academic and journalistic research that would not be possible otherwise due to the ephemeral nature of the ads. This imagined use of TATE has so far been the most promising amongst other scenarios as it can enable research that have real social value.

In addition to this, the above quote embeds insights about the concentration of economic activity in the OBTA market. In chapter 3, the prevalence of OBTA activities around a few big players were discussed. Here, the concerns that comes with this concentration has become apparent: For TATE to be able to afford enhancing the current state of transparency in OBTA, it would have to be first adopted and implemented by the few big players. In addition to this, (p20)'s quote implies that ad-tech companies are likely to not to volunteer for enhancing transparency or adopting TATE. If this is the case, it would mean that the organisational structure resulted from this concentration, potentially has an impact on the incentive structure for transparency.

8.4.2 OBTA Companies

Some of the ways TATE was speculated to come to use went beyond its initial imagined uses at the design stage. An example of this, is imagining TATE as a tool to be used for checking and ensuring the methodological rigour of the processes in behavioural data science. One of the participants mentioned:

'We had a discussion couple of weeks ago internally about this... I think from the researcher's side, from the "I am a scientist and I want to be as rigorous as possible,"there would be a desire to do that. Whether it would happen in the real world when you are time pressed, people are calling for deadlines, I don't know. But I think there would be an appetite for it. Yeah... ' (p7-industry researcher)

Meanwhile, another participant argued that if TATE was going to be used only for checking the methodological rigour on the analytic processes, it would not be much

different from the existing debugging tools that is currently in use in many companies. However, they mentioned that the advantage of TATE would be in bringing the analytic and administrative processes altogether in one place, whilst existing tools often have them separated (p4-Industry researcher). It could be added that having both administrative and analytic processes documented along each other, can be beneficial from an ethics point of view as designers, scientists, and technologists can see the interplay of their decisions together in the wider picture, enabling them to better identify any contingencies rising that might lead to concerns.

Additionally, for some, TATE was speculated to have some affordances as a means for market differentiation both by proving commitments to social corporate responsibility (CSR), and by proving distance and detachment from problematic practices, and re-building trust (p14-publishing industry; p15-publishing industry). For example, when it was asked if TATE offered any capacities as a means for market differentiation for CSR, one of the participants mentioned:

> 'I think to make anything usable, one has to has to go through many iterations before exactly the right information is presented in exactly the right way to get engaged with it. The basic idea is good, it's mapping out the flows of data, what has come from where, and making it visible. And would it be useful to a company like ours? Yes. Potentially. Depending upon our company strategy if we wish to differentiate ourselves in that way, absolutely. If we... If for legal reasons we have to provide that information, then of course. So, so yes. I think this type of initiative is positive for sure.' (p1-adtech)

Another participant noted:

> 'I think business increasingly needs to have a purpose in order to be socially acceptable. I think ad-tech is an interesting extreme example of a business which is arguably unethical and at the opposite end. Not only of questionable purpose, but actually quite negative and destructive in its current state. So yes. Strong yes.' (p15-publishing industry)

In addition to this, consumer trust was confirmed by some as a significant concern from industry:

> '...People are waking up to what some companies do, and I think people will start to be a bit more protective... I'd like to think., but it also potentially means that people who get the data are going to be cleverer as well. And so a trusted brand is a huge thing in this area.' (p6-industry researcher)

The data from the interviews suggest that trust is also a key issue *within* the OBTA industry, and between stakeholders, which has ties with lack of transparency. For example, in relation to the real time bidding processes, one of the participant mentioned:

'...in my view it's not very transparent. So, the problem with the auctioneer is that you could cheat. So the principle of the second price auction is that you are obviously paying the second highest bid. But who trusts this auction? So, the reason why it works is that because you are not actually paying what you bid, you are paying what second highest bidder said, so it's called the truthful auction, it incentivises people to bid their true value, because that is not what you actually have to pay anyway. But then, if you are saying that you have a second price auction, but in the meantime, you are doing something else, that kind of undermines the whole process of the auction. People say they are running it fairly, but is there any oversights? Is there regulation that applies to this? In the financial market there is regulations about how these auctions are run, I'm not so sure if there are any regulations that actually regulates these kind of auctions...

...I think the advertisers have other problems. Because, apparently even if you won an auction, you can resell that auction to others. So with this impression, you can resell that...' (p17-academic)

When I talked to participants from ad-tech about potential trust issues from the perspective of publishers and advertisers, one of the participants suggested:

'... I guess from a publisher's perspective, there is a similar-Ish concern to the actual end-user. What publishers are really concerned about, is part of that offering...

...So for example we are working with ABC1 and ABC2 companies. They are worried that we are going to share their data with the other publisher. Or also, worried that we are going to capture all of that data about both of their publications, put that into a segment of newspaper or whatever -female users/male users-and then go and sell that for our own gain, which we are not doing. But that's a similar kind of worry from the publishers...

...from the buyers' side what they are really worried about is that they have obviously spoken to DSP or buyers operating through a DSP, they would have bought or sourced or have their own data sources about all of the users on the publication. So, what they are really worried about, is that they have spent obviously a lot of time and effort and money, in getting these user profiles, and then put bid on those different users based on that data. What that they are really nervous about with our dataset, is being able to reverse-engineer

what they are doing, which we can do, and we are obviously not doing. But that is what they get concerned about.' (p12-ad-tech)

The above quote suggests that lack of transparency and oversight in the auction and bidding processes contribute to trust issues within the OBTA ecosystem, at least from a financial perspective., but also, it appears that there are concerns about limited agency for transparency. One of the participants said:

'...We have significant concerns over ad-tech. The first concern is what it means for the user, and user privacy whilst we operate in this space. The second consideration is around the commercial implications of ad-tech. The systems that operate, some of which we have a direct relationship with contractually, some of which we don't. But they are doing things to our users with, or without our knowledge, and we have a concern about the "without our knowledge.", and that is where we see syncing happen. And a secondary instance of syncing happens which involves another entity, with whom we have no trading relationship. And which, we may purposefully have no relationship, because, we don't want them to be involved in our transactions. So, ad-tech, I go as far as to say is broken.' (p15-publishing industry)

The above quote sketches a picture of an environment, where companies anxious about brand safety aiming to only trade with non-problematic OBTA practices, have limited agency, in taking a standpoint in relation to their trade relationships. It was suggested that TATE can offer some capacities for such companies as a middle ground between an all or nothing dilemma:

'...we are going to make a stand and say we are not going to do any of this. Because we don't believe we should do it. The problem is whilst we are company ABC with that view, we are very heavily embedded now in programmatic and we are still largely ad-funded based, and to turn off that tap overnight... [Laughs]... To make a political point, we might.... We now don't have a long road left... We would have to come up with something else very fast. So, you know, this would be a softer way of saying that. That we only work with some people and we are committed to make sure you only are profiled by these people.' (p14-publishing industry)

Programmatic refers to algorithmic matching used for matching triples of ads, ad spaces, and website visitors/'eyeballs,' and might or might not involve RTB auctions. Some programmatic practices are characterised by lack of transparency in the trading process, where buyers buy ad inventories without knowing where they would be placed, and who

they are buying the ad space from. Sellers incentive for this might be to sell ad space and eyeballs without disclosing their website, or semi-disclosing it.[1]

(p14) expanded on the claim about having limited agency in choosing their trade relationships, by mentioning that occasionally, publishers might be unaware about the third parties on their websites, whilst they would have to rely on other third party tools and companies to check what is firing off from their pages. However, the means for checking all of this information are limited and/or impractical, sometimes, they cannot be assured, and therefore, sometimes limited to relying on claims to trustworthiness. In these discussions, it is clear that in (p14)'s point of view, publishers have clear incentive for transparency over the operations that goes on on their web pages. From this perspective, (p14) speculated that TATE offers a capacity:

> '...it's very impressive. I think it seems a bit like the tools we have in place at the moment to help us with this kind of thing, but obviously in a nutshell where I can see this differs from the tools we currently use, is we can see who are the bad actors in this space. We know certain ad-tech company, for example, for us is company ABC, or someone who we know cuts our own sales efforts. We know that we don't want to see them on our pages firing... So, we can try and track back where they are coming from. Because in the programmatic landscape, more often than not, the agencies are a big factor. Because agencies are particularly good at hiding pixels within creatives. The way that programmatic works is that we don't get to check a lot of this stuff before it runs. So we have to trust them to behave, and most of the time they do. But then, now, and again, someone has something in there they shouldn't have, and we can flag some. But what we can never see, which I think yours does from my understanding, is that sort of second level. So from a publisher point of view, being able to know what data company ABC are actually collecting there, and using, and why they are using it, that would be immensely powerful I think.
>
> ... So for instance, we have a lot of advertisers and agencies, and now and again, they will buy our inventory in the programmatic space. But they also buy it in the open marketplace, which means that there is not targeting, is like that you're literally just buying on website. And this is why programmatic has damaged us quite a lot... Now, we are finding that more and more they are using it. Because it's easier, and they can do it at scale. They are buying third-party segments from company ABC, and they just want to be on our premium site for brand safety... People are willing to pay this fee to be on our site. But they are overlaying their data. And we don't see any of that. We just see that Advertiser ABC has bought these many impressions. So I

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[1] For description of anonymous, branded, or semi-transparent ad selling/buying see Google (g); Google Ad Manager Help (Google Ad Manager Help).

suppose a use-case I'm thinking there from us, what would be fascinating, is
being able to see what data they are buying.' (p14-publishing industry)

The above quote embeds various points. The claim about publishers not being aware
about what is firing off from their pages has been made by publishers before. For example,
see DCMS (2018, minute 11:12-11:13). This could mean that, publishers who are reliant
on non-contractual programmatic for revenue but concerned with brand damage could
have incentives for transparency, for example, for becoming aware of the third parties,
trade details, and ads on their websites. Meanwhile, there is a second point in (p14)'s
quote about programmatic enabling advertisers to circumvent full prices for ad space
on premium publishers website. However, despite this, at the same time, when I asked
(p14) if they would be interested in adopting TATE, they mentioned:

'...yeah I mean if you turn this on tomorrow, I would be a bit worried because
we are kind of a...I was telling you, trying to sort ourselves out. We are a bit
of a mess at the moment. But we have got an entire team working around
the GDPR around May 2018 to tidy things up. So I will be very... I think
they would welcome something like this come post that time. Because that is
the angle that we want to go as the ABC publisher, we try to be very strong
in that. It is just... So, I think yeah, we would. We would love something
like that where we can say to you this is why you are being targeted.' (p14-
publishing industry)

Meanwhile, despite the incentives for transparency over other parties' operations, there
are anxieties from the perspective of (p14) about communicating their operational details
to consumers, for example, due to its potential damaging effect on consumer trust:

'...People are asking why are you showing me this ad? And we say, technically
we are not really showing you that. It's been a bit out of our control. And
would this be a good way of showing that view? or would the user blame us
for it all and say, well why are you letting companyABC profile me in this
way not realising that the profile is that...? I suppose that is just one way and
that above my head that it could cause... Could be great or could cause issues
for us... You know in terms of how that works. [Laughs]' (p14-publishing
industry)

This is whilst more recently, studies show that, disclosing operational details behind
ad targeting algorithms in their study reduced users misconceptions about 'algorithmic
omniscience' and 'led to algorithm disillusionment' (Eslami et al., 2018). The authors
recommended that advertisers provide explanations about their processes to users, and

enhance the transparency of these disclosure mechanisms to re-build trust in targeted advertising (Eslami et al., 2018).

From the above discussions about transparency with (p14), it can be argued whilst TATE is desirable as a means for having transparency over trade-relationships in the OBTA market, it is not being as desirable for disclosing operational details to consumers. However, on a different note, various participants showed interest in TATE as an 'education piece' for consumers, and gaining their trust in OBTA needed for the generation of online contents and services. One of the participants mentioned:

'So I don't know how much that comes back here but I guess in terms of the actual users themselves I do quite like this application where again, for education piece, I see as "why do I keep getting adverts about ladies' underwear or handbags or something "and then you would be able to click and go "ah... It's because my wife has been using my computer and she's been on company ABC and she's looking at handbags. "' (p12-adtech)

'I think there is a huge education piece on the Internet in general, where people just expect the Internet to be free. Some of them had advertising and they can realise that things don't run for free, and if you do something to stop all of these ads or opt out of all tracking then, people don't know where to start, we won't be having this conversation now. Do we need to start bringing up charging people?' (p14-publishing industry)

In relation to TATE, another participant suggested:

'I think Criteo has done it.[2] And my brain then thinks well why have they done it? It's not like they are under any requirement to have done it to date. So, I imagine they have probably A/B-tested it, and found that actually it does help users. And it is that educational piece. Because yeah my mum clicked the ad choices icon, and actually went through it all, and she actually understood why she was seeing ads. So I think in that respect, to provide education to users, I think this would be useful.' (p13-ad-tech)

The above quotes illustrate interests in TATE as an education piece. But in addition to this, there were interests in TATE from a business/commercial perspective that went beyond the imagined uses of TATE in its initial design. One of the participants mentioned:

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[2]Criteo is a company that offers retargeting services to a wide range of OBTA companies, and their website can be accessed at www.criteo.com.

'I'm really interested in the commercial element, and I realise I'm talking about that but you haven't really explicitly pushed it to me. And I think I to... Yeah my mind wonders as to what happens when the previously, the control layer is backed by a transactional mechanism...'

'Yeah that becomes very interesting from a commercial perspective and thinking about what that means... And again ... the user... it's quite interesting the context of our business, because whilst the audience would nod to the fact that they are not paying, and the probably recognition that we are ad-funded because we have ads, I don't think that value exchange is necessarily explicitly called out, or that is necessarily even regarded as fair. Now, we get some emails from people that say, "I don't like these ads, they are crap."And you have to remind them that the content is free. So there is kind of like how does that play into... Or how could that play into that?...'

However, despite the incentives for enhancing transparency both on the side of the trade-relationships in the OBTA ecosystem and the consumer side, this participant voiced anxieties about lack of other safeguards, and the route to transparency that might be limiting their agency in taking steps towards enhancing transparency. They mentioned:

'Transparency will improve the current state but is not sufficient, and the route to transparency can potentially have a big impact on the ad-tech and publishing industry.

...I see a value upstream and downstream. I suppose the individual is one part in the relationship, and it makes sense that the other party has an equal interest in understanding their contribution and their perception, or their perceived value in that relationship, which not least, could create an opportunity for responsible companies to appraise their own behaviour and reform, or otherwise optimise...

... I think transparency creates new considerations. But I think you overcome... I think that transparency that delivers makes them worthwhile. We probably have a view that is different to other businesses. So I don't think it's easy... It could be quite a challenging transition or switch. But at the same time, we would have to say "well if that is our behaviour then we are responsible to it."And equally, if we are doing anything that we think we should be hiding, I think that would be quite concerning in itself. But again, we are probably in a slightly different position to other businesses, because we have a certain ownership and purpose and values. And the same would be very very challenging for ad-tech when they are trying to make as much money as possible I think. But then maybe that's... Maybe that is the... the point?' (p15-publishing industry)

More importantly, the above quote suggests that whilst there is some agency for enhancing transparency, there are limitations to this agency. On the one hand, some companies that have the incentives for adopting TATE (and enhancing transparency) might not be able to afford its trade-offs, for example due to cost and the underlying condition. On the other hand, there are companies that are likely to not to have the incentives for enhancing transparency. This point was detailed further by other participants in a different context. For example, one of the participants noted:

> '...Facebook is currently under massive fire because -correct or incorrect- for its lacking approach to advertising regulation has allowed foreign actors to influence the US election. Providing it with a system that enables ways to prove that that's not the case, would probably be a good PR opportunity. Unfortunately, what that is actually likely to happen, is that that the system would demonstrate that they absolutely have to allow for that to happen. Therefore, that is kind of negative, from a PR point of view. But providing it with a system assistance and standards that might enable companies to make sure it doesn't happen again could be an opportunity....They are unlikely to give you anything that acts directly against their own interest. Unless there are very very powerful incentives for them to do so. And as a general rule, Facebook has decided that transparency is against their interest. Unfortunately, that seems to be the main issue here...' (p20-publishing industry)

The above quote, re-emphasizes that some companies, in this case one of the dominant companies in OBTA, do not have incentives for enhancing transparency. For example, one of the participants suggested:

> 'It sounds like a tool like this would actually in a very good way weed out a lot of bad players. But then, I just wonder how many companies you would get to opt in the first place. And then, they will just come up with another reason why they weren't opted in: "You know there is a legal reason..., or there is a technical reason why we don't opt-In. But trust us, it is still good."So I suppose... I would be surprised if you get many companies...' (p14-publishing industry)

Meanwhile, returning to the earlier discussions about OBTA practices that rely on lack of transparency in their business models, I asked one of the participants if there might be any incentives for actors who engage in these practices to adopt TATE. They responded:

> 'I don't know... I think ... the pressure probably comes from advertisers, and I think you choose your pressure points... Data comes from publishers in the first instance, the money comes from the advertisers. So, maybe you pick

your battles, and you avoid wasting energy create other pressure throughout the wave...I mean part of this... I mean part of this is not... Yeah this... This eradicates of those businesses. So I don't know how you could possibly tell them otherwise really... I think that... On the bottom I'm biased about that, but that's fine. Yep. They've had their time.' (p15-publishing industry)

Amongst the remaining discussions about TATE's imagined uses for OBTA companies, administration and implementation concerns were amongst the most highlighted. In section 8.3 I provided examples where it was suggested that concerns are not enough to justify the cost of adopting TATE (p13-ad-tech; p18-governance and public policy). In discussing imagined uses of TATE for OBTA companies, costs of implementation, and having TATE as an open standard as opposed to a proprietary system, were flagged as critical consideration.

Therefore, from the discussions in this section, it can be concluded that TATE has capacities on the OBTA companies level, mostly if it is in the form of an open standard with low costs of implementation. It has been imagined to be used for self-auditing, and for communicating operational details to individuals for re-building trust, and for enhancing transparency in the trade in the OBTA ecosystem. In most cases the extent to which stakeholders would have agency to leverage this capacity depends on other factors. For self-auditing, this is a matter of project restrictions, such as time pressure. In the second instance, there were only concerns about negative affect on consumer trust, that are not validated by recent studies (Eslami et al., 2018). As for the latter scenario, this capacity would be dependent on other factors that can restrict stakeholders agency, and for some actors can come with trade-offs.

8.4.3   Governance and public policy

One of the ways in which TATE was speculated to come to use on a governance and public policy level was to facilitate ongoing oversight. One of the participants suggested that they could imagine TATE being used by data subjects, controllers as well as supervisors. They added that

> '... The supervisors actually have or will have under the 2018 applicability of the GDPR, they will have huge competencies to actually access the premises of companies, to require them to provide certain information and I think it would be extremely helpful for them to have this sort of speculative mapping because if they can find these accountability gaps they could actually with that information go to a company and say look I now really need to know this and I can't find it, it's not transparent....'

...'It could also mean that the GDPR gives a lot of obligations to document personal data processing and it could be that the watchdogs with this mapping in hand, can start reading this documentation and say ah but actually, this and that information is lacking. it must be there, otherwise this is model wouldn't work, so they have deliberately, or not deliberately, omitted certain routings or transfers or whatever other types of processing. So I think it would be very helpful...' (p25-academic)

Similarly, another participant mentioned:

'I love the idea of watchdogs going in and being able to sort of monitor or even just audit someone like X and Y, and ask are you correctly profiling these people, or is that a bit of a stretch to be profiling, purely because they just did this one thing...? [Laughs] you know...

... So I mean we find that at the moment a big frustration for us when we do get these third-party data companies that want to work with us, is that they are so black-boxed they won't tell us anything. Or they give us the rough "oh we track data this way."Okay, but with that segment that you are trying to sort me now for a campaign ABC, how do you create those? "Oh well, you know... "and it gets really murky! So, I think that has a really powerful thing there, because we are trying to clean-up that world at the moment, but the way that we are trying to clean-up is all contraction. The GDPR says you have to be compliant for doing this... I have not seen any real technical focus on ways to really actually check how someone is profiled in that way. So, I think my hunch would be that is where you're going to get more traction.' (p14-publishing industry)

Another participant imagined the purpose of TATE to be contradictory to its use by regulatory bodies:

' ... a watchdog is a body with power, where the individual doesn't have power. And part of me feels that actually what you've talked about, empowers the user, to the extent where it actually changes the nature... Possibly changes the requirements or the value of the watchdog itself. So, yeah, maybe then my question is with users empowered, do you still have the old-fashioned type of watchdog? Or actually do you create the framework for self-regulation which exerts equal if not greater pressure and creates kind of lines of accountability in probably a far more robust fashion as well...?

.. Well there is the Advertising Standards Association (ASA). So, if an appropriate piece of content is put out, it has to be seen by the user who then

has to then go to the effort of reporting it, and it's quite a linear process, which looks very different to what you're talking about.

...I suppose creates a greater weight of expectation and accountability around behaviour that actually reduces the opportunity for bad actors to do something to get away with it. There is a paper trail.' (p15-publishing industry)

However, as mentioned in the previous section, the above opinion about the self-regulatory framework was not shared by some of the other participants. For example, a participant mentioned:

'I don't think the industry can be relied on to effectively self-regulate. I mean, there is no evidence thus far that it can. So, my question would be, would this effectively going to add additional burden to people? To advertisers and actors who are trying to do the right thing, while effectively just providing potentially smokescreen or cover for people who aren't doing the right thing...?' (p20-publishing industry)

(p15)'s claim about the higher value of self-regulation bares contradictions with the history of the previous interventions presented in chapter 5. Meanwhile, (p20)'s point about cost discussed in the previous section is an important consideration, and so is the concern over misuse of TATE. In relation to this, others suggested regular visits from an independent body to inspect the algorithms, albeit in the wider domain of algorithmic decision making. They noted:

'So, on the algorithmic side, I would go back to the idea that there is an independent other body or in particular a government body that is able to say I want to inspect your algorithms. I think is it something like an inspector of algorithms..., it's in and out visits like revenue customs or that, saying actually I want to see your algorithms, I want to see the training data, we want to see how this is used in practice. Because I think the transparency on its own is not likely to be enough.' (p18-governance and public policy)

On the other hand, when I raised the concerns about TATE being misused as a leverage point for tokenism to other participants, one participant mentioned:

'It is not like auditing cars, where even with auditing cars we get cheated, with diesel ignitions and so on. So, there is also something we are learning that you can cheat very easily in the industry.

... so, you know, Uber's use of Greyball.[3] So, those are kind of shocking for the regulator, because we think we are working in the public interest,

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[3]Uber's Greyball program was reported by NYTimes to deliberately make if difficult for regulatory authorities to find Uber drivers (Calo and Rosenblat, 2017).

and we also see the public push-back against those companies isn't like what you would assume it would be. There are other companies that get much more stick for perhaps less offences. It is not like the consumer corrects the market, no longer using Uber, and no longer buying Volkswagen. And so, not quite sure how to deal with this. But auditability frameworks for the digital economy are very important I think.

...maybe we are aware that there is an issue, and we want to regulate it but we don't know how to do it, and in a way that it doesn't kill the entire industry or destroy the internet...[laughs] so, maybe one thing for me would be helpful would be to extract those elements of your framework which actually can be generalised even to other frameworks, this is like a general auditability framework which provenance has that.'

...I think that your standard to me is very similar to Do Not Track standard from W3C. I mean technically not, but it has the same public policy objectives, or similar policy objectives as your intervention...

...Maybe the underlying problem is that there is no alternative to monetising content rather than advertising at the moment online. Which maybe this statement is not true because for example in the app store we are ready to pay for apps, and the willingness to pay for apps in exchange of no advertising. Ad blocking on apps doesn't work at least so far so I don't think that it works on the web browser or the mobile browser but it doesn't work on the apps. So that ecosystem is different, and maybe people's attitudes towards paying in exchange for something else is different. Maybe that will dominate, I have no idea. So, what is the problem the underlying problem that we are trying to solve... and there I think that taking your approach together with the Do Not Track approach and stepping back a little bit, what is the underlying problem...

...That's a good approach. I mean I think that is very good, ... because you describe the final situation in ways that allow you then to either back-casting to, then decompose. It also allows you to critically test whether people in different stakeholder groups share this vision of this future, you know. So, that sounds great.' (p19-governance and public policy)

The above quote can be interpreted to suggest that there is a desire for enhancing transparency from the governance and public policy point of view, and whilst policy makers have agency, this agency is conditioned by the underlying social, political and cultural context. This context might be co-produced by the interplay of the organisational structure of OBTA, the underlying political economy and its reliance on the auditing culture that tends to attend to the symptoms of the problems more than the structural issues (Strathern, 2000), and the entanglement of OBTA in the Web.

Meanwhile, some of the participants imagined TATE to be incorporated into existing governance and public policy provisions and measures. One of the participants noted:

> '..that would tie in sort of with some of the stuff in the GDPR with regards to accountability ...There is a lot of talk about the certification of data processing activities and privacy seals. So, basically, the average user knowing if something certified that it's not safe to use, but that they are going to respect the processing of personal data. So that ties in with that idea that if you have got this aggregated repository of showing people which companies and which businesses are, and aren't being open and transparent, then, it can help. Whether that creates a ranking system, or something that can help them make decisions and stay in control about using companies that they know, that respect what will happen with their data. And that's quite a key thing I think. (p2-governance and public policy)

On a similar note, another participant suggested:

> ... ' I'm going to simplify this enormously, -so I see advertisers, intermediaries, and publishers. That's the distinction that I think the article 29 working party used in its behavioural advertising. Now, already between these three, there is a lot of lack of transparency because the advertisers usually don't get to see the data at all. They get to compete for advertising space, but that's all. They sort of have to believe that this is going to help, but there is no way they can actually check. So, even within the industry, it might help to create a level playing field between different partners. And if that leads to advertisers saying "hey wow, we are being taken for a ride, we are paying a lot of money but all the information we actually need to see whether that contributes to the sale -to put it very bluntly-is hidden from us. So we are being taken for a ride."And that might help to reconstitute the market in a way that this models can revert back to for instance charging people for a service, instead of monetising your data ' (p25-Academic)

The above quote suggests that there are capacities for TATE to be used on the governance and public policy level, but at the same time, this could potentially be disruptive for some of the companies. In addition to the above imagined uses, one of the participant noted that there might be some capacities in TATE to uncover what a particular provision in public policy could mean in practice:

> '...So, we were chatting to people around the industry ... we had a lot of conversations around it was around privacy. some of the guys in the publishing industry were quite convinced AI will solve all the false news problems. ...I

think there is a lot of confusion... in people who are expected to implement
for example, the new data protection and data privacy rules what they ac-
tually mean how people are going to interpret them, is almost an interest to
think if you use your tool to show the complexity of what data protection
means...To put in the context of the new data protection rules and regulations
where everything needs to have explicit permission, if you hold somebody's
data and that kind of stuff, what exactly is that going to mean? To what
extent is implied consent sufficient? To what extent would people do on the
consent chain if they knew where the data was going and things like that?'
(p4-industry researcher)

P4 here is suggesting that TATE could offer a capacity for regulation research to explore
how regulatory safeguards are enacted in the OBTA ecosystem. On a separate note, a
participant pointed to a sociotechnical imaginary on the governance and public policy
level as a means for moving towards addressing the concerns. They mentioned:

'... the oligopolistic concentration in those markets is worth looking at, be-
cause, competitions solve many problems, because people can choose an ad
server that have different features. You know it's the same thing with the
browser market. Some of these problems is related to a lack of competition.'
(p19-governance and public policy)

The above quote suggests shifting the focus of policy to competition law as it would be
likely that competition would solve many of the concerns and questions around OBTA.
This argument is based on a key assumption, that ultimately, Web users are respons-
ible for their choices, as opposed to the market being responsible for only providing
responsible choices, and having safeguards for preventing harm. However, despite the
assumption, the reference to anti-trust action offers a promising direction. It is often
emphasized that competition law should be used in combination with other safeguards
and obligations. For example, Pasquale (2010) argues that innovation and competition
law can help restructuring organisations in a way that new business models emerge, that
can promote accountability and responsibility if employed alongside consumer protec-
tion. Shapiro (2018) proposes to 'move antitrust enforcement forward in a constructive
manner during a time of widespread and growing concern over the political and eco-
nomic power of large corporations in the United States.' For example, they recommend
'tighter merger control' whilst not attacking successful firms that obtain dominant po-
sitions. These proposals offer potentials, that are currently the subject of policy and
public debate.

Finally, there are concerns about over-regulation within the industry, and that problem-
atic practices can affect the whole OBTA industry and ultimately, the Web (p1-adtech;
p19-governance and public policy).

'To start running campaigns political campaigns on Facebook, I think it's very very valid. For our company, you know... we are targeting brand ads to individuals. So we are outside of this area. But again, it is an industry. It should be an industry concern. Because what it invites is over-regulation. By that, I mean... I really mean not thought-through legislation. So, there are a lot of people who are making laws who are... not experts in the field. Now that is geared but it has to be balanced by the people who are. And typical... As soon as there is a public scare about something happening like social engineering or the Russian influence on the American election, then, there is always a tendency to put legislation in place quickly...any legislation, and that's bad. Very very bad.' (p1-adtech)

The concerns of over-regulation are linked with lack of transparency that do not enable researching OBTA. Challenges in the way of research can lead to oversimplified regulatory solutions with potential side effects.

8.5 Revisiting features, and design of the conceptualised model

This section reflects the data from interviews that included discussions about the processes behind designing the model, and the quality of its features for communicating and presenting the information to the individual web users. The aim of this, is to revisit/validate the processes involved in designing the model. As suggested by some of the participants, a thorough examination of these processes within the limited time frame of interviews is not possible. However, it was asked if anything is flagged from a general overview of the scenario, the sequence diagrams, the model, and the speculative approach for presenting information on the web user level. Responses did not flag any fundamental issues, but there have been suggestions for adjusting the model and revisiting the requirements. Meanwhile feasibility from a technical perspective was speculated on a wide range, with concerns mostly falling outside of the speculative design framing, instead focusing on issues such as latency (p-11-ad-tech), security (access control) [informal chats], and privacy [informal chats]. The remaining of the discussions centred around stakeholder analysis, extending requirements, and discussing approaches to presenting the information for other imagined uses and users. These are detailed in what follows.

8.5.1 Stakeholder analysis, scenario, and sequence diagram

There were cases that I engaged with more that one participant from the same company in interviews or informal chats. In these cases, often the key role of the company was

interpreted differently by participants. As a result, in these cases, the stakeholder group that the participants defined themselves in, differed from other participants of the same company. This suggests that there are fluid boundaries between stakeholders that can move depending on interpretation and perception.

Meanwhile, a missing stakeholder was flagged during the interviews. A participants suggested that *media agencies* are currently missing from the diagrams and the stakeholder analysis, whilst they are of considerable importance in the OBTA operations, particularly, to the publishing industry. This missing stakeholder, however, does not change the core architecture of the model and could be incorporated into the diagrams and the model as part of the future work without fundamental changes.

From discussions about the hypothetical scenario, and the sequence diagram, there was no major concerns, and some suggested that they provide a realistic picture. Most of the discussions about the features and design of the model, centred around extending the current deliverables to include requirements for other imagined uses and users, and providing examples of speculative interfaces for each. In the following sections I detail these discussions.

8.5.2 Current imagined use on the web user level

This section reflects participants comments about potential adjustments to the model, requirements, and the speculative approach taken for presenting the information for TATE's imagined use on the web user level that the current design of the model is based upon.

Some of the participants suggested that the requirements might need adjustments. For example, on a generic level, it was suggested that *duration* is an important property of OBTA entities that is currently missing from the model. For example, duration of the data retention, or an expiry date for the profile, or the ad. These are new considerations to be added to the requirements:

- **Req7.** When is the expiry date of Alice's profile?

- **Req8.** During what period was the ad targeted to Alice?

- **Req9.** During what period was the ad campaign running?

Furthermore, in relation to flexibility and interoperability, I asked one of the participants about the applicability of the model with the complexity of the mobile ad ecosystem. More specifically, I asked whether it would be possible to track activities that correspond to data collection through a mini black-boxes that represents *collect*, and document its inputs and outputs as conceptualised in the model. In response, they said:

'Yes it would. Yes, absolutely. As I understand that, I think there are a
certain key flows through here which can be extracted. Yes.' (p1-adtech)

Meanwhile, participants had different views about the speculative approach to presenting
information on the web user level, as illustrated in figure 7.18. For some, the approach
taken raised concerns for not being user-friendly. For example, one of the participants
said:

'yeah...So, it needs to be friendly. So, actually, from what you are doing and
how you are using it, I cannot think of any tweaks at all. But from a user
perspective, yeah...' (p7-Industry researcher)

Similarly, another participant emphasised the importance of clear communication as
a key challenge, and highlighted the need for making the information actionable, and
making the the feature for providing explanation, and communicating operational details,
visible and noticeable to the web users:

'I think that interpretation, that ability to communicate what is it that it
is offering, is probably one of the biggest challenges. Because, this is why
some brilliant offering services have failed to communicate what they actually
offered to the customers really well...'

'...I think there is a difference between giving me information and allowing
me to do something quick and easy about it as well.' (p6-Industry researcher)

For some, the speculative approach for providing explanations about the ads was satis-
factory when compared to existing approaches. A participant mentioned:

'... I think that is really powerful. Because certainly I know from the user
point now... So, I as a user when trying Ghostry for curiosity, tells me what
is firing, tells me a bit about the company, but it never gives me insight into
why I am seeing that ad in particular. Just as you can see an ad-unit via
app-nexus or something like that. So, I think that is hugely powerful. There
is a lot of the things that I'm not seeing anyone else be able to do, which is
really fascinating.' (p14-publishing industry)

Moreover, since the conceptualized model has been presented within the framework of
speculative design, requirements such as latency, scalability, etc. are not considered.
This can have key impact on users agency in using the capacity offered by TATE on the
web user level. However, many of the participants talked about these issues that remain
considerations for future work.

8.5.3 Other imagined users and uses

The interviews suggest that some for imagined uses and users, low or no adjustment might be required, whilst the discussion suggests that some of the imagined uses, would need adjusting the model, or the processes behind its design such as requirement analysis. I detail these in what follows.

In cases where TATE was imagined to have capacities for use by OBTA companies to self-audit their own processes, to identify accidental issues from the interplay of administrative and analytic decisions (p15-publishing industry), or for enhancing the methodological rigour (p7-Industry researcher), adjustments were not suggested to the model, whilst some highlighted the importance of considering the timing of self-auditing. For example, in relation to the activities abstracted from the sequence diagrams, one of the participants mentioned:

> 'I can't think of anything that is missing... I think that's a very good list actually. What we debated is to have a very similar list to you actually... Might even borrow your slide! And it is to have a sort of a checklist when we have collected data to document we did this, and there is an issue here, and a potential issue there. And actually, regardless of who has collected the data, or for analysis, it shows any issues with collection, compilation, and more. I think that's a really good list...' (p7-Industry researcher)

In relation to the timing of self-auditing for companies, one of the participants highlighted a point about potential costs and risks to reputational damage that could raise with self-auditing after implementation, and recommended considering self-auditing practices before implementation. They noted:

> '...So, I would definitely see the best place to be in the creation side whereas the post-Implementation is kind of too late. It not only becomes potentially brand damaging if you've got it wrong, but also it becomes quite costly to fix.' (p7)

Similarly, the participants did not discuss adjustments for other imagined uses and users. However, in many of these cases, adjustments are necessary. For example, the above quotes do not cover other imagined uses for TATE on the companies level, these might require further research, and might involve adjusting the model. Examples include business strategies for market differentiation (p1-ad-tech, p15-publishing industry), or in using TATE as a trust-building mechanism to provide a more nuanced choice than blocking ads (p14-publishing industry, p12-ad-tech).

Moreover, using TATE for facilitating journalistic and academic research, was not discussed in the interviews. However, this would require adjusting the model to document

information in a way that only reflects the processes, relationships, and entities of OBTA actors involved in the OBTA mechanisms, exclude the activities, or entities specific to individual web users such as cookies, restrict documentation to more general entities such as segments, etc., and limit querying to aggregate information. Therefore, some of the information that are currently conceptualised to be documented by the model would need to be omitted, so that they are not documented in the first place, whilst restricting queriable information to an aggregate form.

Similarly, imagined uses on the governance and public policy level, would require adjusting the requirements. Determining the exact details of requirements, and what should not be documented, would require further research, preferably ethnographic research, or further interviews with policy makers.

Meanwhile, participants often highlighted the critical role of interface design for all imagined uses and users of TATE, that can have considerable impact on the agency of the imagined users for the imagined uses. One suggestion was in relation to an interface for the company level. It was suggested to consider just in time notice functionalities for both publishers and advertisers. For example to indicate when some new parties are heavily bidding on a particular consumer (hinting to a potential for ad fraud), or when impressions are resold, or when the prices significantly vary (e.g. sudden increase of price) (p17-academic).

The interviews also highlighted the importance of design decisions for implementation and administration. A participant highlighted:

> 'As with a lot of technology, I think a lot comes down to how it is administered. Because my feeling over this thing would be different if you told me it would be applied by Google in their browser, versus it being an independent open source or something else.' (p15-publishing industry)

Other key considerations include presentation of actionable information to users, user experience, and privacy and security considerations all of which require further research as part of the future work.

8.6   Conclusion

This chapter illustrated how TATE exercised speculative design in practice. The conceptual model was turned into an analytical device for analysing the dynamics of the current state of OBTA and contributing to a sociotechnical understanding of their technologies and practices.

Chapter 4 illustrated how concerns surrounding OBTA are not all due to 'bad practices,' or inherent to their technologies, and some rise from a constellation of contingencies

and intentionalities that their condition of possibility might be limited by an underlying cultural, social, technical context.

The more nuanced speculations about TATE showed that there are capacities across disciplines and stakeholders for enhancing transparency that can be mobilised, although these capacities are often limited. Discussions also centred around arguing that given certain conditions, TATE offers some capacities for this. Fulfilling this capacity would largely depend on degrees of stakeholders agency which itself would be impacted by the underlying conditions. Meanwhile, the degree of optimism on whether or not these conditions could be met by the current incentive structure varied. Some of these conditions are symptomatic of the organisational structure of the OBTA ecosystem. However, conditions are not fixed and are not inevitable, and enhancing transparency can play a key role in changing them. In analyzing the speculations in this chapter, attention was paid to places where potential capacities are identified for improving these underlying conditions. Moreover, in addition to transparency, other imaginaries for reforming the organisational structure of OBTA from the interviews included anti-trust enforcement.

TATE was imagined to offer capacities for some of imagined uses and users. However, stakeholders agency to leverage this capacity in many cases is limited and dependent on the underlying conditions. For example, the agency of Web users in using TATE on an web user level, would largely depend on sociotechnical skills, the user interface, and the notice-ability, action-ability of the presented information, and clarity of the mechanisms for communicating operational details.

On the companies level, the underlying conditions could include costs of implementation, open standard vs proprietary. There are also anxieties about the potential contribution of problematic practices contributing to moral panic caused by their media coverage, leading to simplistic and ill-informed legislation and over-regulation (p1-adtech). Meanwhile, having transparency can be one way to debunk exaggerated and over-simplified stories and bring back nuance to the public and policy debates.

The data from interviews in this research also shows existing trust issues amongst the OBTA stakeholders (p13-adtech, p12-adtech, p17-academic,p14-publishing industry, p15-publishing industry,p11-adtech, p20-publishing industry). Moreover, there are anxieties about the route to transparency, stemmed from trust issues within and between stakeholders in OBTA industry, particularly, about the concentration of power in the OBTA market. Based on this, the agency of companies that have a desire for using TATE for imagined uses such as enhancing social corporate responsibility, was suggested to be limited by the organisational structure of the OBTA industry. A potential approach would be to prioritise adoption by the more dominant companies.

TATE was imagined to offer some capacities for public policy for example, to be incorporated in privacy seals and data protection assessment. But more generally, the agency of policy makers in intervening for transparency is limited by the underlying

condition of the political economy such as over-reliance on the auditing culture, as well as the increasing entanglement of OBTA in the Web. Speculated approaches to overcome this was to additionally, facilitate visits from independent bodies for inspecting algorithms (i.e. Auditing audits). Meanwhile, having TATE as a standard to be enforced by self-regulatory groups was accompanied by anxieties about costly new policy requirements (e.g. for TATE's adoption) for companies with a desire for SCR, whilst providing smokescreen for the bad actors. Cost is a generally a key consideration that requires development to prioritise considerations about costs of implementation.

A promising imagined use of TATE was in relation to its usage by academic and journalistic researchers for studying targeted advertising. For example for journalistic research, this could mean adjusting the model to only capture aggregate level information. The documented data can enable studying ads, and the provenance of operational details behind them, that in combination with existing ad-archives such as ProPublica's, can provide a rich source for research and enable public scrutiny, that would otherwise not be possible due to the ephemeral nature of the ads. This imagined use of TATE would not include data on the web user level about data collection activities. For academic research, since academic institutions have ethics boards that oversee the conditions of data collection and processing, the model could be used by OBTA actors as it is to enable academic research.

A future for TATE, can therefore be characterised as an open standard for communicating operational details, with low costs of implementation, for the purpose of academic and journalistic research, prioritised to be adopted first by the most dominant OBTA platforms before other companies. This will require capacity building, such as optimising for low/no cost of implementations, and prioritising adoption by the more dominant companies.

The combination of TATE and respondents' speculations about its affordances in this chapter, has enabled a sociotechnical exploration of OBTA technologies and practices and the dynamic of their ecosystem, that has been the main aim of this thesis. The next chapter builds on the findings in this chapter to join others calling major OBTA actors to enable empirical research on their operational details.

Chapter 9

Conclusion

This Chapter provides a summary of the research conducted in this thesis and discusses the integrated theoretical approach adopted in this thesis in section 2 in relation to the result of the interviews presented in Chapter 8. Following this, the conclusions that can be derived from this research are presented and recommendations are put forward. As part of this, the chapter claims that there is value in using speculative design as a means to inform the design of interventions and public policy. Then the importance of enabling academic research on the OBTA operations is discussed, and it is recommended that major OBTA companies enable academic research on their operational details to enable investigating when and where OBTA raise issues for informing the public and policy debate, not least as part of building trust.

9.1 Introduction

This thesis started from a premise that the history of the Web is one of change. That the web consists of a dynamic network of human and nonhuman actors with competing and aligning interests that make the Web what it becomes. The theoretical approach adopted in this thesis as described in Chapter 2, employed a framing for understanding the emergence and evolution of OBTA and concerns surrounding them that acknowledges that society and technology are mutually constitutive, and argues that achieving positive change requires mobilising sociotechnical agency.

Chapter 3 argued that when the emergence of OBTA around the time of Web 2.0 is historically contextualised, their contingencies can be better understood to rise from the mutual shaping and co-evolution of multiple economic, political, technical, cultural and social forces that cannot be separated from each other. This includes the structural relations of the political economy and its effects on the publishing and advertising industry, the consumer culture and subcultures such as micro-celebrity culture and demands for

the free model of online content and services, Web technologies that were re-appropriated for the purpose of tracking and targeting, sociotechnical relations co-produced from the interaction of web users on the Web, the data broker industry that had started their work years before the arrival of the Web, and various other forces. Similarly, the evolution of OBTA to their current status as key business models on the Web cannot be explained by one single dominant force and requires considering a combination of forces and their effects on each-other. Therefore, causality behind why OBTA evolved to become a key business model for the Web and the contingencies rising from this, is dispersed and cannot be oversimplified or exaggerated by isolating a single dominant force.

Chapter 4 explored the concerns in the wider domain to contextualise the concerns surrounding OBTA. It was argued that so far, examples illustrate that concerns can rise not only due to wrongful, or mistaken use of OBTA technologies and problematic practices, but also from the contingency rising from the mutual relationship between society and technology. For example, contingencies may be rise from the intersection of OBTA's technical affordances and their underlying social and cultural context. Therefore, it was argued that understanding the concerns requires considering how the technical affordances of OBTA intersect with social and cultural contexts in which they operate: Depending on the combination of their technical affordances and their underlying social and cultural context, OBTA could be exploited for anti-democratic purposes and widen the social, cultural, and economic gaps, or, be employed for reducing inequalities. Therefore, one single factor cannot be isolated to explain how issues rise. However, the question at hand is whether the affordances of OBTA in particular social and cultural context can condition (e.g. enable, or facilitate) our social capabilities in avoiding and dealing with issues.

It was suggested that answering this question and better understanding the concerns surrounding OBTA, requires more empirical research, supporting similar calls from other researchers (Anstead et al., 2018). However, empirical research on OBTA has currently been very limited as OBTA technologies and practices currently lack transparency and investigating their operations are not made accessible for researchers. As a result, it was suggested that the first step towards investigating the concerns is to explore sociotechnical mechanisms for enhancing transparency. In the wider domain of algorithmic decision making, there have been examples whereby enhancing transparency has largely contributed to investigating the concerns and diagnosing when and where issues rise (Caruana et al., 2015, pp.1721), as well as re-building trust (Pu and Chen, 2007; Wang and Benbasat, 2007).

Despite the benefits of enabling research, in reviewing the previous interventions surrounding OBTA and the wider domain in Chapter 5, it was argued that mechanisms for transparency have been limited and often isolated as technical or legal solutions. Sometimes transparency and notice and choice have been conflated (Bruening and Culnan,

2016). Some provide limited or generic information to web users about how their information is collected, processes, and used, enabling them to set their preferences (Google, 2011). Legal mechanisms that allow subject access request, are often partial, or presented in such way that finding information in them is difficult (Ausloos and Dewitte, 2018). Opening the source code comes with challenges as it runs the risk of concealing crucial information behind a layer of complexity (Ananny and Crawford, 2018). Technical approaches to algorithmic transparency are complex and challenging and so far, have not been addressing the social concerns at hand (Selbst and Barocas, 2018). As a result, there is a gap in transparency mechanisms that can enable research, not only on the internal operations of a single OBTA actor, but on how actors relate with other sociotechnical actors in a larger network in a way that can provide a big picture of the organisational dynamics of the OBTA ecosystem. The thesis argued that this would require mobilising sociotechnical agency as it would require OBTA actors to document and communicate the administrative and analytic details of their operations in an interoperable way that can enable research. Designing such system could be controversial due to the divergent and competing interests of actors in the OBTA ecosystem. The thesis aimed to leverage this characteristic for provoking wider discussions as one of the features of speculative design.

Following this, Chapter 6 described the processes of designing the research and outlining a methodology for conducting the research. The theoretical approach adopted in this thesis detailed in Chapter 2 took inspiration from various works of Haraway to explore an experimental approach that employs new methods of mobilising new forms of agency for driving positive change in two steps: The first part of the research involved using speculative design to conceptualise a model for enhancing transparency in OBTA, and the second part employed the conceptual model to engage with OBTA actors and provoke discussions through key informant interviews.

Speculative design shaped the framing of the first part of the research. The value of speculative design is advocated in the emerging field of design sociology as a means to problematise conventional assumptions about the future, and opening up possibilities for alternative preferable futures (Lupton, 2018). Speculative design is not directly concerned with problem solving, but employs intentionally controversial features to provoke discussions that can go beyond the conventional way of thinking and challenge assumptions and conventions (Lupton, 2018, pp.5). A model for documenting and communicating analytic and administrative operational details in OBTA was conceptualised using software engineering methodologies and the PROV data model. Forming a hypothetical OBTA scenario and decomposing the interactions of a range of actor-groups involved, facilitated the conceptualisation of the model.

The second part of the research involved key informant interviews where a broad range of actor groups were invited to discuss the affordances of the model, and if and how it

could be re-purposed to be adjusted, specified and used in their domains. Wider discussions were provoked as part of the interviews on a broad range, from the overlapping and competing perceptions about the concerns surrounding OBTA, to nuanced views of the capacities of the model, or outright rejection of transparency, or the rejection of the model due to its technical feasibility often despite researchers request for the exclusion of such concerns. Amongst these, the proposed model was suggested to offer capacities for enabling research, particularly journalistic, academic and regulatory research. Additionally, it was concluded that its experimental approach bears sociotechnical value for better understanding the concerns surrounding OBTA, and investigating how the current incentive structure can be re-imagined and adjusted to accommodate more transparency in OBTA technologies and practices.

9.2   Returning to the theoretical approach

The theoretical approach adopted in this thesis suggested that no single dominant social, technical or politico-economic force can explain the emergence and evolution of OBTA in isolation from other forces. A similar argument was also applied to the concerns surrounding OBTA, suggesting that technologies themselves do not raise concerns, but the intersection of their affordances with the underlying social context can sometimes lead to issues. Discussing the concerns with the participants sometimes implicitly, or explicitly, elevated to bigger concerns about the incentive structure. For example, one of the participants suggested that there is currently an inherent misalignment in the current incentive structure, that is currently undergoing change. They noted:

> '...the truth is that the incentives of individuals and the advertisers were never aligned through the system in the middle. They just weren't.' '... the GDPR is incentivising the advertisers especially, and everyone on the right side of that block diagram that you had...so what is happening right now is that there is almost a pincer movement going on where people who go way back to parts of [Internet governance body] that are not captive to the system in the middle, the interests and incentives of them, and advertisers are coming in to an alignment' (p16-consumer advocate). '...the publishers have been completely corrupted by the SSP, the ad broker, and the DSP, all working for the agencies and they know it at this point ....And they all tell you that oh we are completely clean because we're just dealing with agencies, whereas in fact they have sold themselves a long time ago' (p16-consumer advocate).

The above participant implicated various actor groups, including the publishing industry, ad brokers and the advertising companies contributing to the misalignment in the incentive structure. Meanwhile, other participants pointed to cultural forces as other

co-producers of this misalignment that highlighted different aspects of this debate (p1-ad-tech; p14-publishing industry). For example, several participants emphasized the role of consumer culture:

> '...we all want to somehow assume that we are allowed to read a newspaper for free. We expect quality journalism but we are not ready to pay for it [laughs]. So those are the societal attitudes as well, that I am a bit contradictory about...'(p19-governance and public policy)

> 'it's quite interesting the context of our business, because whilst the audience would nod to the fact that they are not paying, and they probably have the recognition that we are ad-funded because we have ads, I don't think that value exchange is necessarily explicitly called out, or, that is necessarily even regarded as fair. Now, we get some ... We get emails from people that say I don't like these ads, they are crap. And you have to remind them that the content is free.' (p15-publishing industry)

> 'Well in theory, that data pays for the service that they get. So you don't pay for Facebook. You don't pay for Google. The fact that your data is out there, is in the partners, there is a pretty hefty implied contract around that notion of free where a lot of data is given up.' (p11-adtech)

The above quotes on the consumer culture about the notion of the 'free model,' highlight some of the arguments from chapter 3 about how the changes in the consumer culture at the time of Web 2.0. and new business models for online service providers co-produced each other, went through mutual processes of change and co-evolved together along with various other factors that should be considered when thinking about current over-reliance of the Web on OBTA. However, the consumer culture cannot be singled out as a dominant force either, and has to be considered as part of the wider context.

Similarly, other participants highlighted the role of industry culture in driving positive change. For example, one of the participants argued that so far, the industry has shown little promise in the area of self-regulation (p20-publishing industry), whilst another highlighted the importance of brand reputation and social corporate responsibility as one of the markers of good reputation in the OBTA industry both on the business and consumer fronts (p6-Industry researcher). These arguments link to Chapter 5 that highlighted the role of industry culture, for example, in self-regulation and promoting social corporate responsibility within the context of previous interventions for transparency in OBTA such as W3C DNT.

The thesis, considered multiple relations the political economy, consumer culture, the data broker industries, the technological design and development of OBTA (Chapter

3), the regulatory and governance sector and the industry culture (Chapter 5) mutually shaping and evolving over time. Various sociotechnical actors are therefore, implicated in the processes of change that have led to over-reliance of the Web on OBTA and its current incentive structure. The analysis from the interviews has been aligned with the theoretical approach taken in the thesis as it suggests all actors groups are implicated in the issues rising from the misalignment in the OBTA incentive structure.

Additionally, the theoretical approach adopted for exploring capacities for change surrounding OBTA can be examined in relation to the application of speculative design. The speculative design of the model provoked wider discussions that provided a rich account of the current dynamics of the OBTA ecosystem. For example, the model provoked discussions about the monopolistic nature of the Web businesses and the effect of the political economy on the current state of OBTA, and the significance of the politico-economic relations in the agential capacities of the OBTA companies for enhancing transparency. For example, a participant described how in the current conditions if TATE was to become enforceable for all OBTA companies, it could act as a burden on smaller companies, recommending that the major OBTA actors become the initial adopters (p20). This can be considered valuable information for designing future interventions for transparency, illustrating how speculative design of a sociotechnical intervention can therefore, be a valuable method for researching the dynamics of the ecosystem before embarking on technical development and implementing the interventions. This is whilst every so often, large efforts are put into delivering technological solutions and policy recommendations that aim to solve the concerns surrounding the Web. As the aforementioned participants pointed out, some create burdens for smaller companies, whilst conveying as a method of tokenism for larger companies. This is a reminder that dealing with the concerns surrounding OBTA requires a sociotechnical lens that can offer a nuanced approach. Meanwhile, cultivating the capacities for 'response-ability,' a word used by Haraway that was detailed in Chapter 2 in OBTA, requires insight into the political dynamic and business culture of the OBTA industry and considering the networked and relational nature of agency for driving positive change, and speculative design can provide one such approach. As a result, a key conclusion of this thesis is that speculative design offers a potential as an approach for research in the area of Internet Governance and policy making.

Another theoretical inspiration of this thesis comes from the concept of sociotechnical imaginaries that now can be explored in relation to the findings from the interviews. The wide range of theoretical perspectives described in Chapter 2 can help recognising some of the sociotechnical imaginaries that were described in the discussions rising from the interviews. For example, the view that the concerns surrounding OBTA can be addressed with more data, can be linked to solutionism that were criticised for lacking nuance in considering the relationship between technology and society. Moreover, as described in the beginning of Chapter 4, there are hyperbolic claims about the powers of data for

knowing the social world that requires attention. This could mean that on their own, more data might not be as desirable as they are expected to be. At the same time, the sociotechnical imaginaries of the new disruptive technologies that can address the concerns surrounding OBTA, fall into futurism and can be criticised for deterministic approaches, and oversimplified stories of the relationship between technology and society. Meanwhile, there were more nuanced imaginaries that considered that the combination of affordances of OBTA technologies and social and cultural forces can lead to mirroring and magnifying existing social issues (e.g. p13-adtech). This is aligned with the argument presented throughout the thesis (e.g. Chapter 2 and 4) that the combination of the affordances of OBTA technologies as they intersect with social and cultural relations that can lead to issues, and investigating when and where issues rise, requires sociotechnical research.

Being informed about the power of the above imaginaries is essential in monitoring how our expectations about the future are shaped and changed over time. The more nuanced imaginaries that open up spaces for cultivating capacities for positive change can also be identified, to concentrate the efforts for re-working a consumer and business culture that moves towards aligning the incentives structure of OBTA in a way that addresses the social issues rising from them, and ultimately enable imagining new alternative futures for the Web. The application of speculative design in this thesis experimented with a new method for cultivating capacities, that even-though partially, can hint to gaps and spaces where adjustments and interventions may be imagined.

9.3 Recommendations and Future Work

As argued throughout this research, understanding the concerns surrounding OBTA and when and where they raise issues requires more empirical research. Many have suggested that currently OBTA are opaque, making academic and journalistic research that serve the public interest challenging. The results of the interviews confirm the urgency of enabling research on OBTA operational details, particularly when prioritising major OBTA actors. In the recent years, there have been on-going requests from academic and journalistic researchers to these platforms for opening up their operational details for research. For example, leading members of the Internet research community responded to the access restrictions to APIs imposed by some of the key OBTA actors, highlighting the need for mechanisms that can support thorough independent investigations of the impact of platforms on society (Bruns, 2018). These researchers have called for platforms to expand their model of engagement with scholarly research by enabling access to custom APIs for research purposes and the use of research data repositories (Bruns, 2018). Enabling research is particularly important with the recent public concerns about

privacy, to enable assessment of the problems. Meanwhile, academic and journalistic institutions often have ethics review boards and national data protection agencies that oversee the process (Bruns, 2018).

The findings from this research support the calls for enabling academic and journalistic research on OBTA operations, particularly in the case of major OBTA actors. TATE provided a platform for discussing the capacity for enhancing transparency in OBTA, and amongst its imagined uses, enabling research for academic and journalistic researchers offered a promising potential. Mobilising this capacity, requires further engagement with domain experts (e.g. journalists and academic researchers) to enable adequate levels of knowledge elicitation for adjusting the social and technical requirements, and revisiting the model as part of an iterative process as part of the future work.

In conclusion, the processes involved in designing the research in this thesis and the steps taken for conducting it, have contributed to an-going sociotechnical exploration of OBTA. The nature of this research is not prescriptive, and is mainly exploratory and descriptive. Meanwhile, the insights from this thesis can be incorporated into sociological thinking about the future of the Web. This raises the question ***how can this understanding be used for sociotechnical future making for the Web?*** that can be explored as part of the future work. In looking for answers to this question the theoretical approach taken in this thesis and the methodological approach offers a promising potential for engaging with actor groups and disciplines, and experimenting with partial solutions that can open up spaces for mobilising new forms of agency for enabling and driving positive change.

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