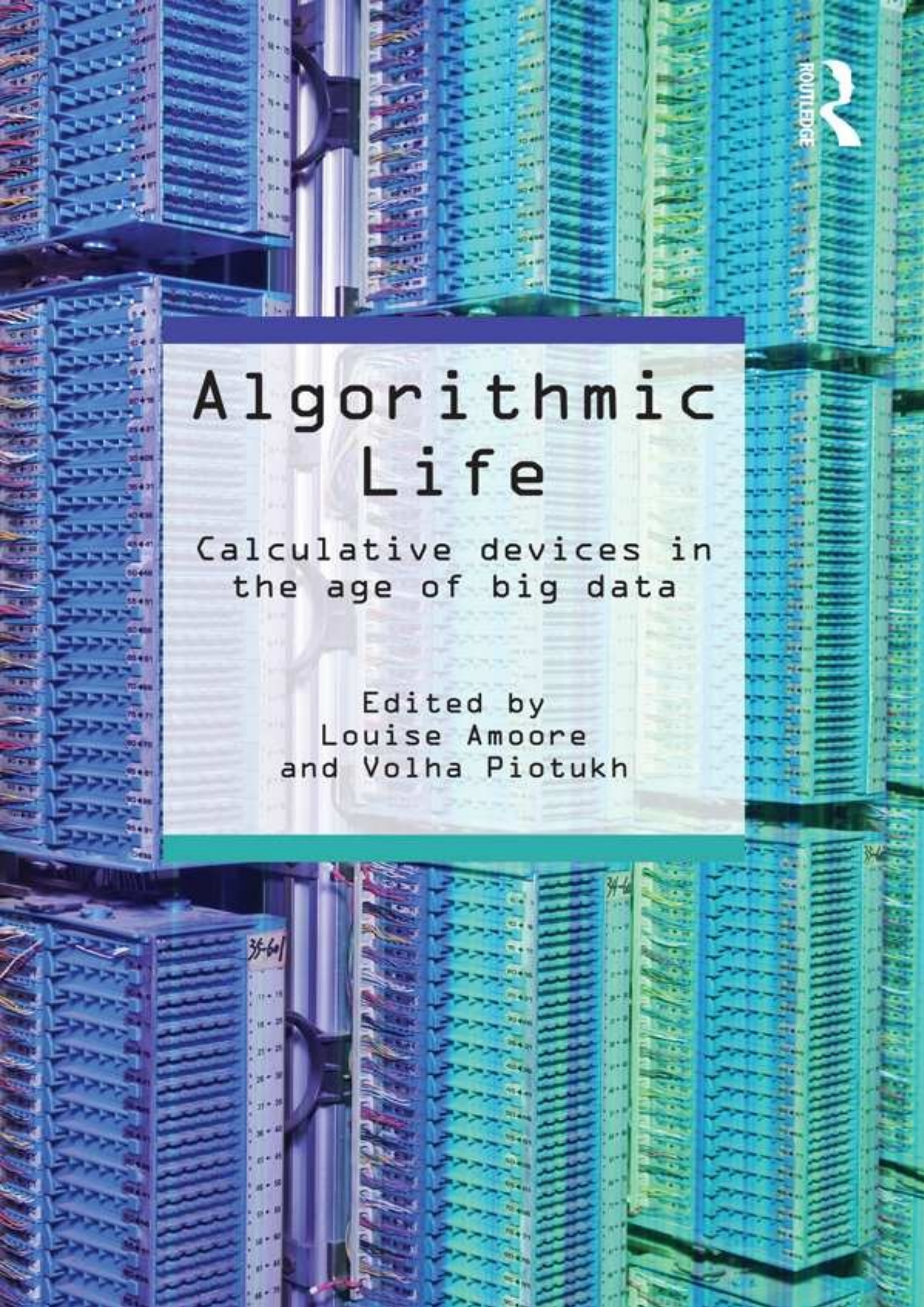
ROUTLEDGE
Algorithmic Life
Calculative devices in the age of big data
Edited by
Louise Amoore
and Volha Piotukh

Algorithmic Life

This book critically explores forms and techniques of calculation that emerge with digital computation, and their implications. The contributors demonstrate that digital calculative devices matter beyond their specific functions as they progressively shape, transform and govern all areas of our life. In particular, it addresses such questions as:

- How does the drive to make sense of, and productively use, large amounts of diverse data, inform the development of new calculative devices, logics and techniques?
- How do these devices, logics and techniques affect our capacity to decide and to act?
- How do mundane elements of our physical and virtual existence become data to be analysed and rearranged in complex ensembles of people and things?
- In what ways are conventional notions of public and private, individual and population, certainty and probability, rule and exception transformed and what are the consequences?
- How does the search for 'hidden' connections and patterns change our understanding of social relations and associative life?
- Do contemporary modes of calculation produce new thresholds of calculability and computability, allowing for the improbable or the merely possible to be embraced and acted upon?
- As contemporary approaches to governing uncertain futures seek to anticipate future events, how are calculation and decision engaged anew?

Drawing together different strands of cutting-edge research that is both theoretically sophisticated and empirically rich, this book makes an important contribution to several areas of scholarship, including the emerging social science field of software studies, and will be a vital resource for students and scholars alike.

Louise Amoore is Professor of Political Geography at the University of Durham and ESRC Global Uncertainties Leadership Fellow (2012–2015).

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Introduction

Louise Amoore and Volha Piotukh

> If we give the machine a programme which results in its doing something interesting which we had not anticipated I should be inclined to say that the machine *had* originated something, rather than to claim that its behaviour was implicit in the programme, and therefore that the originality lies entirely with us.
>
> *(Alan Turing, 1951)*

Introduction

On a cold day in November 2014, IBM explain to an assembled group how their Watson cognitive analytics engine learns about the relationships between things. Described as a "technology that processes information more like a human than a computer", Watson is taught what the relations among data might mean, rather like a child is taught to read by associating symbols and sounds (IBM, 2014a). "A subject specialist is required", explain IBM, in order to "teach Watson the possible relationships between entities". The subject specialists could be policing authorities with knowledge of criminal behaviours, or revenue and customs authorities with knowledge of patterns of fraud, or they could be medical scientists searching for links between existing drugs and new applications (IBM, 2014b). It can take around four months of what IBM call "nurturing" for Watson to learn these subject-specific relationships between the data elements it ingests. Once the learning from a test data set has taken place, however, Watson is able to continue to learn as new items of information are added to the corpus of data. As Alan Turing speculated some sixty-three years ago in his discussion of whether automated calculating machines could think, the machine that is Watson does result in something interesting that had not been fully anticipated in the programme, and thus the originality does not lie entirely with human creativity.[1]

How might we begin to think about the new forms of calculation that emerge with digital computation? Of course, in one sense understanding the relationship between the algorithm and forms of calculation is not a novel problem at all. Understood as a decision procedure that predates the digital era, the origins of algorithmic thought have been variously located in Leibniz's notebooks of the seventeenth century (Berlinski, 2000: 5) and in the twentieth century mathematicians' disputes on decidable and undecidable propositions (see Hilbert, 1930; Gödel, 1965; Turing, 1936). Yet, with the twenty-first century rise of big data and advanced analytics, the historical question of calculating with algorithmic decision procedures appears to be posed anew. Indeed, the '4Vs' of 'big data' – increased volume, variety, velocity, and veracity of data elements (Boyd and Crawford, 2012; Mayer-Schönberger and Cukier, 2013) – demand new kinds of calculation and new kinds of human and machine interaction to make these possible. But what happens to calculation, with the emergence of new ways of enumerating and modelling human behaviour? How do new digital calculative devices, logics and techniques affect our capacity to decide and act, and what are the implications for the governing of society, economy and politics? In a world of changing data landscapes, how do mundane elements of our existence become data to be analysed and rearranged in complex ensembles of people and things? When the amount of available data is such that it exceeds human capacities to read and make sense of it, do contemporary modes of calculation, based on constant incorporation of heterogeneous elements, produce new thresholds of calculability and computability, allowing for the improbable or the merely possible to be embraced and

acted upon? Does something original emerge out of these calculations, as we might inquire with Turing, something of interest, which had not been anticipated in the programme?

The aim of this book[2] is to critically examine algorithmic calculative devices, logics and techniques that emerge in a world characterised by a vast proliferation of structured and unstructured data. The predominant scholarly and public emphasis on the 'big' in big data has tended to obscure what we call the 'little analytics', the arguably smaller and less visible calculative devices without which this world of big data would not be perceptible at all. As others have argued, the apparently vast array of contemporary data forms are rendered "more or less tractable" via the algorithms that make them amenable to analysis (Hayles, 2012: 230; Hansen, 2015). If the metaphor of big data is to continue to capture our understanding of digital life, then it cannot have meaning without algorithmic calculative devices. From the financial subject's online access to sub-prime lending (Deville and van der Velden in this volume) to the biometrically enabled battlefield (Nisa in this volume), and from potential partners and lovers (Mackinnon in this volume) to personalised urban locations (Widmer in this volume), we are increasingly intertwined with algorithmic calculative devices as we consume information, inhabit space and relate to others and to the world around us. Yet, just as being human may also be closely enmeshed with being algorithmic, these calculative devices also alter perception, filtering what one can see of big data landscapes, how one makes sense of what can be perceived. As Evelyn Ruppert, John Law and Mike Savage (2013: 24–25; original emphasis) suggest, there is a profound need for "a conceptual understanding of the *specificities* of digital devices and the data they generate".

In this book, a diverse range of specific algorithmic calculative devices and application contexts are discussed (e.g., from insurance to counter-insurgency, from fire and rescue to addressing obesity, and from credit-rating to on-line dating). Beginning from a commitment to examine algorithmic devices *in situ*, the book also develops analytical and methodological tools for understanding calculative logics and techniques that reach across the diverse domains.

Beyond probabilities: calculative devices of knowledge discovery

The use of statistical calculative devices for enumerating population – what Ian Hacking has called "the making up of people" by the state – lay at the heart of nineteenth century knowledge of society (Hacking, 1986; see also Bowker and Star, 1999). The rise of methods for population sampling and statistical analysis witnessed the emergence of profiles for what Adolphe Quetelet called *"l'homme typique"*, or the average man, a probabilistic figure whose attributes could be known and acted upon (Daston, 1995). Just as the nineteenth century "avalanche of printed numbers" (Hacking, 1982) was twinned with devices such as punch card machines to make sense of the newly available data, so the twenty-first century rise of digital big data is paralleled by innovation in the analytical devices required to read, process and analyse it.

Yet, where the management of the avalanche of printed and tabulated data observed by Hacking was concerned with the capacity to index data in structured and directly retrievable forms, the proliferation of digital data traces has brought about vast quantities of unstructured, incomplete and fragmentary elements. As Victor Mayer-Schönberger and Kenneth Cukier (2013) observe, the rise of big data witnesses two parallel phenomena: an expansion in what can be rendered as data, or "datafication", and an extension of the capacity to analyse across heterogeneous data forms, such as across text, image files, voice or video. In this way, big data can be seen as simultaneously a product of, and impetus for, new digital calculative devices. The contributions in this volume provide many examples of this double transformation: from online behaviour turned into data through tracking (e.g., Deville and van der Velden) to biometrics, including voice and gait (e.g., Nisa), and from attitudes, opinions and interests, datafied as 'likes', 'check-ins', status updates (e.g., van Otterlo; Widmer), to affects, emotions and feelings (attraction and love in Mackinnon; anxieties in Coleman, but also in Nisa, Belcher, O'Grady).

The twinned processes of data expansion and analysability are also significantly challenging conventional social science understandings of what it means to draw a 'sample' of data from a population. The twenty-first century claim that "n=all", or that everything can now constitute the sample, extends the limit of sampling to an infinite spatial horizon (Gruhl et al., 2004; Chiao-Fe, 2005). Indeed, for some commercial purveyors of data analytics, the core of the issue is to dispense with the notion of the sample and sampling altogether, so that one can work with the patterns and correlations of any given dataset:

> Data science is inherently diminished if you continue to make the compromise of sampling when you could actually process all of the data. … In a world of Hadoop, commodity hardware, really smart software, there's no reason [not to do this]. There were good economic reasons for it in the past, [and] prior to that, there were good technical [reasons]. Today, none of [those reasons] exists. [Sampling] is an artefact of past best practices; I think it's time has passed.
>
> *(Inbar, in Swoyer, 2012)*

Yet, although the rise of big data has extended the availability of data sets, the completeness suggested by "n=all" is an illusion, according to Hildebrandt (2013). One of the important reasons why 'n' can never truly equal 'all' is because, as Hildebrandt puts the problem: "the flux of life can be translated into machine readable data in a number of ways and whichever way is chosen has a major impact on the outcome of data mining operations" (2013: 6; also Kitchin, 2014). In this sense it is insufficient to make claims about the infinite availability of data without careful attention to how it is analysed, and to what can be said about the data on the basis of that analysis. As Danah Boyd and Kate Crawford point out in this respect, there are many reasons why "Twitter does not represent 'all people'" (2012: 669), and so analyses of vast quantities of Twitter data cannot provide insights that can be meaningfully said to refer to the population as a whole.

In this book, we are concerned with the new calculative devices that have begun to shape, transform and govern all aspects of contemporary life algorithmically. As Michel Callon and Fabian Muniesa (2003: 190) have proposed,

> Calculating does not necessarily mean performing mathematical or even numerical operations … Calculation starts by establishing distinctions between things or states of the world, and by imagining and estimating courses of action associated with things or with those states as well as their consequences.

Though the work of contemporary algorithms does involve the performance of mathematical functions, at least at the level of the machinic code (Dodge and Kitchen, 2011; Berry, 2011), it also actively imagines and estimates courses of action associated with things or states of the world. In this sense, and following others who have understood market calculative devices as things that do the work of making the market itself (Callon and Muniesa, 2003; MacKenzie, 2006), for us algorithmic calculative devices are re-making our world in important ways. Indeed, as David Berry (2014: 2) has argued, "we are entering a post-digital world in which the digital has become completely bound up with and constitutive of everyday life and the so-called digital economy". While the chapters in this volume explore the work of algorithmic calculative devices across multiple domains, here we wish to highlight four aspects of algorithmic life that surface across these plural spaces.

First, calculative devices in the age of big data are engaged in the filtering of what can be seen, so that they create novel ways of perceiving the world and new visibilities and invisibilities. In Laura Poitras's Academy award winning documentary film *'Citizenfour'*, for example, Edward Snowden refers to the "ingestion by default" of "bulk" communications data by the US National Security Agency (NSA). The vocabulary of ingestion is central to data mining practices, where the programme absorbs that which is considered valuable, while filtering out that which is not of interest.[3] The idea of data *ingestion* suggests a qualitatively different process of "bringing something to attention" from the traditional forms of data *collection* one might associate with social statistics (Crary, 2013). From the Latin *"in-generere",* to carry into, to ingest suggests a process of drawing in quantities of matter into an engine or body, such that the contents can be filtered, some of them absorbed and others expelled or discarded. The calculative devices

designed to work with processes of ingestion are capable of analysing many data types and sources simultaneously. Thus, the qualitative differences between video, image files, audio, or text files have to be flattened in order for "previously hidden patterns" to be brought to the surface of attention (Che, Safran and Peng, 2013: 7).

How does an object or person of interest emerge from such calculative processes? How are qualitatively different entities in a heterogeneous body of data translated into something quantitative? As IBM describe their *Intelligent Miner* software, the task is "to extract facts, entities, concepts and objects from vast repositories" (2012: 2). Here the calculative devices extract subjects and objects of interest from a remainder, making those items perceptible and amenable to decision and action. Noting that "sense perception" can be "changed by technology", Walter Benjamin (1999: 222) in his account of mechanical reproduction was concerned with the acts of cutting and separating that make possible entirely new angles of vision and "sequences of positional views". For him, the technologies of cutting and dividing associated with the advent of mass media do not merely render more precise and accurate something already visible, but instead reveal "entirely new formations of the subject" and "entirely unknown qualities of movement" (230). In our contemporary present, the partitioning of data elements by technological means similarly alters the landscape of what can be perceived or apprehended of the world (Crary, 1999; 2014).

> Relational databases are good at storing and processing data sets with predefined and rigid data models. For unstructured data, relational databases lack the agility and scalability that is needed. Apache Hadoop makes it possible to cheaply process and analyse huge amounts of both structured and unstructured data together, and to process data without defining all structure ahead of time.
>
> *(MapR for Apache Hadoop®, 2015)*

The promise of devices such as Hadoop software is to be able to analyse multiple data forms without defining all queries and structure ahead of time. In this process of "knowledge discovery" (Dunham, 2002), as Elena Esposito suggests, one "infers knowledge with no need for a theory directing it, one explains the world with no need to know the underlying causes" (2013: 127). In contrast to the deductive production of knowledge from *apriori* queries or hypotheses (e.g., by using profiles), in this case data analytics use inductive and abductive logics (van Otterlo, 2013; Kitchin, 2014) to identify previously unknown patterns in a large volume of data so that the devices are said to "let the data speak" (Rickert, 2013). A person of interest, or a thing of interest, is thus made visible on the future horizon of possible associations and connections, and not only from the statistical probability of past events. As the leading designer of early IBM data mining software, Rakesh Agrawal, has explained, first generation devices "used a statistical notion of what was interesting", so that the "prevailing mode of decision making was that somebody would make a hypothesis, test if it was correct, and repeat the process" (Agrawal, 2003). With the advent of large linkable databases and extensive unstructured data sources, however, "the decision making process changed": a series of algorithms in an analytics engine would "generate all rules, and then debate which of them was valuable"

(Agrawal, 2003). A related aspect of these developments is a shift in focus from causation to correlation (e.g., Zwitter, 2014), which "is based on a consequentialist understanding of meaning: to explain the meaning of a correlation one does not revert back to causation but one looks forward to what it might effect" (Hildebrandt, 2013: 7). An important implication of this shift is the perceived interchangeability between correlation and causation,[4] which further foregrounds the emphasis on anticipation and pre-emption (e.g, Kerr, 2013). As Boyd and Crawford (2012: 668) further warn us, "often, Big Data enables the practice of apophenia: seeing patterns where none actually exist, simply because enormous quantities of data can offer connections that radiate in all directions".

At the same time, knowledge discovery has become a significant process in the governing of future uncertainties. Recalling Edward Snowden's accounts of the "ingestion" of bulk data, arguably the process of knowledge discovery precisely requires the bulk data in order to generate the subjects and objects of interest. As the UK House of Commons Intelligence and Security Select Committee concluded in March 2015, in response to the Snowden events, "this may require the agencies to sift through 'haystack' sources in order to identify and combine the 'needles' which allow them to build an intelligence picture" (UK ISC, 2015: 25). A person or thing of interest (a target or 'needle') thus comes to the surface of visibility only through the filtering and partitioning of a vast background of structured and unstructured data (the 'bulk' or 'haystack').

Second, calculative devices in the age of big data are transforming the ordering of space, territory and sovereignty (Berry, 2011). Notwithstanding the apparently deterritorialising processes of cloud computing, or offshore data trading and analysis, algorithmic calculative devices simultaneously reterritorialise data storage and analysis in physical space (Paglen, 2009; 2010). A 2014 US court ruling can serve as an illustrative example. According to the ruling issued by US Magistrate Judge James Francis, "private emails and personal information of web users can be handed over to US law enforcement – even if that data is stored on servers outside the US" (Gibbs, *The Guardian*, 29 April 2014). The spatiality of algorithmic life is thus not solely related to the augmented experiences of urban life, or the multiple sensors of the Internet of Things, but also to the space of sovereign decision as it is instantiated within calculations.

By way of example, the US Transportation Security Administration (TSA) deploy a form of "sovereign information sharing" software, which allows them to analyse data from across databases or across territorial jurisdictions. On the one hand, such methods do require the territorialised and material infrastructure of data warehousing we see in Paglen's (2009; 2010) images. Yet, on the other hand, they also inhabit and make possible novel spaces of sovereign authority. Sovereign information sharing is a calculative software tool that facilitates "computation across autonomous data sources in such a way that no information other than the intersection results is revealed" (Agrawal, 2005: 2.1). The sovereign authority may thus conduct a search across a sub-set of data on persons or things that cross a pre-determined threshold, while annexing the big data sample from which it

was drawn. In the case of the TSA, the airlines sustain a form of sovereign control over their passenger name record data, whilst the security authorities govern their watch list data, with the advanced analytics running the "intersection results" for matches, associations and patterns (Amoore, 2013). "The TSA agrees that the use of the intersection results will be limited to the purpose of identifying suspects", write the computer scientists responsible for trialling the technique, "but it will store only the metadata" (Agrawal, 2005: 6.5). The calculative devices used to run the intersection results are thus not merely authorised by sovereign power, but more precisely they are a burgeoning part of the condition of possibility for the exercise of sovereign authority (see also Nisa, Belcher, Leese, in this volume). Not only do the algorithms of sovereign information sharing appear to make possible sovereign decisions about who or what might pose a risk to US transportation security, but they also instantiate the threshold at which a person crosses a border as such, and enters a particular sovereign jurisdiction.

Third, calculative devices in the age of big data significantly reorient the temporalities of our world. The capacities to search and analyse larger volumes of data at faster speeds – whether in the algorithms for high frequency trading on the financial markets (MacKenzie, 2006) or in the hyper-reading of text-mining algorithms (Hayles, 2012) – have become depicted as 'real time' calculations. Software company Tibco's® *Spotfire*® analytics, for example, promise to "turn data into actionable insights" so that data on unfolding events can be used to enable fast and strategic "real time" decisions. The software for stream-based analytics engines such as *Spotfire*® identifies links between events coming from multiple data sources. In this way, the data on Twitter trends, smart phone meta data, online transactional data, sentiment data, such as Facebook 'likes', are analysed in association in order to anticipate possible future changes, what *Tibco*® call the "two second advantage":

> You are under greater pressure than ever to spot emerging trends and patterns hidden in vast quantities of multi-variant data … Spotfire helps you anticipate opportunities and risks by seamlessly integrating predictive models and real-time event streams to deliver the Two-Second Advantage.[5]

Algorithms for event stream processing are being used in the commercial world in order to anticipate intertwined threats and opportunities, such as the propensity of a customer to 'churn' and transfer their custom to a new provider. As such, techniques travel and cross over into the security domain, propensities for future violence or 'attack planning' is thought to be similarly identifiable at the joins between multiple data elements. Advanced event stream analytics, such as those in *Tibco*® *Spotfire*®*,* suggest that a transformation is taking place in the temporal relations of past, present and future, as close to 'real-time' event data is processed in association with stored data on past events, in anticipation of a future that may be seconds away.

Yet, such changes are not accurately described as "real time" in the sense of the durational time of lived experience (Bergson, 1912; Deleuze, 1991). Thus, as Berry (2011: 152–153) contends, what we have with data streams is "the storing of time as space", which

"allows the linear flow to be recorded and then reordered". In turn, "[t]he shifting from chronological time to the spatial representation means that things can be replayed and even reversed, this is the discretisation of the continuous flow of time" (Berry, 2011: 153). The calculative devices of big data analytics actually spatialise time in such a way that there is a foreclosure of plural potential futures. What matters for these devices is the capacity to map the spatial distances data-point to data-point – the associations, correlations and links. As Hayles has described the different temporalities of measured time and time as experienced process, this can be "envisioned as the difference between exterior spatialization and interior experience" (2012: 112). In this sense, the "two second advantage" is measured in clock time and may capture little or nothing of the many durations of experience beneath the gathered data points, which has important implications:

> The confusion of space and time, the assimilation of time into space make us think that the whole is given, even if only in principle … And this is a mistake that is common to mechanism and to finalism. The former assumes that everything is calculable in terms of a state; the latter, that everything is determinable in terms of a program.
>
> *(Deleuze, 1991: 104)*

Finally, calculative devices transform the nature of human subjectivity, pushing at the limits of what can be read, analysed and thought about (Hayles, 2012). With new forms of data aggregation and knowledge discovery, come also more advanced forms of profiling of human behaviour (e.g., van Otterlo, 2013; Magnani, 2013), fuelling the emergence of new, and often poorly regulated, business models and entities, such as consumer data aggregators (Amazon, Facebook, Google, Twitter) and data brokers (e.g., Roderick, 2014), and new forms of government and commercial dataveillance and behaviour manipulation (e.g., Degli Esposti, 2014; Prins, 2014; van Otterlo in this volume). Contemporary data analytics do not merely gather the fragments of past activities and transactions, including those generated by "prosumption" and "playbour" (e.g., Beer and Burrows, 2013), in order to project the future, but they also model and financialise the *propensities* and *tendencies* of life. Thus, for example, the sportswear retailer Adidas deploys what it calls "consumer DNA" in order to imagine and model what future desires and wants might be. Tracking the clickstream data of individuals who have watched the latest Adidas advertisement on YouTube, Adidas propose to gather the 'DNA' of their customers – the chained elements of their lives that make a particular product-line desirable. Understood in this way, calculative devices shape our capacity to decide and to act in the world in ways that cannot be fully excavated or known to us, posing a challenge of retaining the individual's agency (Berry, 2011; Simon, 2013, in Zwitter, 2014: 3) and privacy (e.g., Hildebrandt and de Vries (ed.), 2013; Tene and Polonetsky, 2013; de Goede et al., 2014; Zwitter, 2014; Peacock, 2014)). The consequences for the life chances of people, for inequalities and discrimination are many (e.g., EDPS, 2014; Peacock, 2014; Widmer, Nisa, Belcher in this volume).

Overview of the structure and chapters of *'Algorithmic Life'*

The book has 10 chapters organised into four thematic sections. Beginning with a section on '*Algorithmic life'* (Chapters 1–2), the book focuses on the ways in which algorithmic models and automation change our understanding of life in terms of publics and information control. The *'Calculation in the age of big data'* section (Chapters 3–5) explores the spaces in which predictive algorithmic calculations take place and the ways in which they shape the physical space around us. The *'Signal, visualise, calculate'* section (Chapters 6–8) considers the calculative devices engaged in the production of visualisations and visualities, and their effects. Finally, the *'Affective devices'* section (Chapters 9–10) examines calculations related to the body, emotions, and temporalities.

Possibly nowhere else has our increased reliance on algorithms as digital calculative devices become more apparent than on the web, as, without them, it would be a disorderly and unnavigable space. However, according to Andreas Birkbak and Hjalmar Bang Carlsen (Chapter 1), algorithms used by such web services as Google, Facebook and Twitter do much more than just order the web, as they also enact the social in specific ways, acting as what they describe as a new kind of 'public official'. Indeed, seeing algorithms in such a way, the authors argue, allows appreciation of "how calculative devices not only explicitly generate the worlds they claim to describe, but also the moral trope from which we are to judge and act on this world". In their experimental analysis of algorithms used by the data giants, Birkbak and Carlsen reveal differing ordering logics and challenge the alleged indispensability and objectivity of web algorithms. By considering possible alternative orderings, for example those produced by *ForceAtlas* or based on the liveliness of content, the authors show that other relationships between the public and its algorithms are possible.

Continuing with the theme of ordering effects produced by algorithmic calculative devices, in Chapter 2 Martijn van Otterlo focuses attention on the ways in which devices, acting as artificially intelligent librarians, shape our consumption of information. He argues that understanding how these new algorithmic 'librarians' rearrange digital libraries for individual users helps us to appreciate the overall power and ubiquity of algorithms. According to van Otterlo, algorithms use three mechanisms to exercise control over information: measurement/access (determining who can see what); prediction (use of rules generated by prediction models); and manipulation (using prediction to influence behaviour). For example, search engines act as gatekeepers to their respective digital libraries, with serious consequences for our ability to surface particular kinds of knowledge. This leads to the conclusion that, perhaps, "the biggest threats do not come from oppressive forces of surveillance, but from algorithms acting as friendly librarians who nudge and manipulate" via more prosaic everyday means.

The age of big data is characterised, among other things, by the ability to leverage for

analysis a variety of digital traces, including those produced by smartphones and their users. Calculative devices, such as location-based applications, allow these traces to be utilised for different purposes, from analysing behaviour and preventing customer churn to personalising services and changing the ways in which users experience their surroundings. In Chapter 3, Sarah Widmer examines the *Foursquare* application in terms of how it mediates between its users and the New York City urban environment. *Foursquare* deploys the activity of other smartphone users and the data content they produce, mediating through personalisation algorithms. Widmer locates the personalisation performed by *Foursquare* within broader trends towards the increased personalisation of goods and services and increased customer engagement, which turns consumers into "prosumers". At the same time, Widmer is concerned with the effects of automatic personalisation, such as creating new regimes of visibility/invisibility and locking users into what Pariser (2011) has termed "filter bubbles". In her analysis, Widmer points to the divisive effects of personalisation and the incomplete and fragile nature of digital traces on which it is based.

In Chapter 4, by drawing our attention to what he terms a "politics of redeployment", Nathaniel O'Grady demonstrates how new anticipatory risk logics and techniques become localised and redeployed in a particular setting, that of the UK Fire and Rescue Service (FRS). In critically examining the digital assemblage of the FRS, O'Grady focuses on everyday processes, from data collection to data analysis, that make the calculations of fire risk possible. In particular, he points to the significance of data integration for calculating risk, and reveals how certain additional types of data, such as fire fatality data, are absent from digital circulation processes, but get mobilised by analysts in their decision-making. According to O'Grady, risk calculations performed by the FRS are also conditioned by the temporal heterogeneity of data; for example, when data regarding previous fire distribution is correlated with potential lifestyle distribution in order "to secure the future in the now". These insights contribute to a better understanding of the role played by universally available software and dis-embedded global data flows in enabling new public-private security assemblages and in reshaping emergency governance.

In their contribution in Chapter 5, Joe Deville and Lonneke van der Velden engage in a challenging task of making visible the invisible digital work of credit trackers as a particular type of online data gathering tool. In their analysis, they focus on what they call "digital subprime", a market for credit occupied by such entities as Wonga, Kreditech, ThinkFinance and Zestfinance. These lenders secure necessary information about their current and future users by extracting, compiling, and algorithmically processing a highly diverse range of online 'traces' from potential borrowers. In their experiment, the authors use the *'Tracker Tracker'*, a tool that repurposes the tracker detector *Ghostery*, to gain an insight into the tracking work of digital subprime sites by revealing what types of data these sites are interested in and the tools they use to acquire them. In particular, the authors reveal the reliance on plentiful, diverse and instantly available data types,

including browser information, IP address and time of visit, with credit history being less important than might be otherwise expected. Put simply, the links and associations between a potential borrower's past online activities become more significant profiles than a historical credit record. In mapping out and analysing a complex bricolage of tracking tools and associated calculative practices used by lenders like Wonga, Deville and van der Velden raise broader methodological questions about studying algorithmic calculative devices from the outside, along with questions regarding the ethics of online tracking and its practices of data 'maximisation' and customer segmentation or profiling.

The reliance on digital calculative devices to facilitate decision-making has also been growing in other areas, where the consequences of their use can mean the difference between freedom and detention, as Richard Nisa demonstrates in Chapter 6. Nisa critically examines the ways in which the use of digital biometric technologies, aptly abbreviated as HIIDE and SEEK, have transformed the US military practices in the battlefield. Once enrolled through handheld digital biometric devices, physical bodies become datafied and are algorithmically processed (e.g., by establishing links with their behavioural data 'shadow' and evaluating similarities with the already known profiles) in order to determine their 'riskiness' and inform the decision of the capturing soldier. In this way, the calculation, made possible by a broad range of digital technologies, travels from individual biological traces to 'calculated publics' and traverses geographical and virtual spaces. In so doing, not only does it transform specific military practices, but also reminds subjects of their position as "an object of information, a target of governance and a potential target for lethal force".

Calculative devices used inAfghanistan and Iraq have a long lineage, as Oliver Belcher reminds us in his contribution (Chapter 7) focused on the computer-based Hamlet Evaluation System (HES), which was introduced by the US military in 1967 in Vietnam. The HES represented an ambitious attempt to "survey, catalogue and calculate population patterns (and … trends) in a war zone", an attempt at gaining a 'total information awareness' down to the granular level of individual hamlets. For Belcher, the introduction of the HES resulted in a profound transformation of how Vietnam as an operational environment was to be understood, including a displacement of subjective judgement by a supposed more 'objective' view produced by computation. Crucially, quantification had characterised previous US imperial exploits, as well as all major colonial projects, but the HES, with its reliance on digital computation, held the promise of gathering and analysing volumes of data far in excess of human capacities for calculation. While the use of HES was characterised by what Belcher terms "data anxieties" regarding the reliability of the input data and visualisations (maps and reports) produced on its basis, the HES computational enframing enabled new kinds of targeted violence.

In the age of big data, as Matthias Leese points out (Chapter 8), the ability to make sense of large volumes of data becomes more important than ever, with visualisation functioning as "the translation from the algorithmic environment back to the realm of human

readability". In examining flagged PayPal transactions and images produced by airport scanners, Leese, like Belcher, questions the supposed 'neutrality' of visualisations and points to their political dimension and to their ability to govern the future through affective modulation. While visualisations of risk are expected to be objective representations of reality, they are shown to rely on obscurity and on reduction of complexity and context, with only a digital artefact made visible. This artefact – a flag, an exclamation mark, a yellow dot – functions to produce an uncertain space where the worst case scenarios are imagined. These imaginaries, as Leese argues, contribute to the atmosphere of suspicion, thus reinforcing the anticipatory mode of governing.

In drawing our attention to transformations taking place in the affective domain of love, in Chapter 9 Lee Mackinnon shows that, with the proliferation of new calculative devices, from algorithms powering dating websites to smartphone dating applications, such as *Tinder*, a calculation of chance is being replaced by a technique of probability. An important element of this transformation involves the apparent shrinking of the distance between self and other and removal of the temporal suspension, characteristic of love's indeterminacy, by accelerated connectivity. When a potential lover is presented as a list of characteristics, amenable and controllable through digital processing, "the discomfort of longing can be dispensed with and the subject given over to the prophylactic of instantaneous novelty". In critically examining assumptions and findings of a study that used the Gale-Shapley (GS) algorithm to simulate stable matches between men and women, Mackinnon reveals some of the significant limit points of algorithmic computability and suggests that it is precisely uncertainty surrounding love's nature that "is the essential instability upon which love is based". In her analysis of affective calculative devices, Mackinnon also comments on their ability to traverse disparate domains and to perform a radical homogenising flattening of all difference, with human subjects reduced to artefacts.

In Chapter 10, Rebecca Coleman examines the *Change4Life* programme as a social marketing campaign that further "extends economic calculation into the realm of the social". Following Moor (2011), Coleman suggests that, by making the social problem of obesity calculable, the campaign functions to limit the political debate about how this problem should be addressed. She shows how, in its targeting of obese and overweight, the campaign is informed by, and engages in, constructing a very particular future, a future dominated by the impending health and associated financial crises. The *Change4Life* campaign functions preemptively, in that it intervenes in the present to pre-empt a potentially dangerous future of obesity from unfolding. According to Coleman, these interventions are aimed at producing healthy bodies by intervening directly into the lives of those deemed to be most at risk and, in so doing, they create new social differences. In her discussion of the *Change4Life* campaign, Coleman points to broader effects of pre-emptive governance by calculation, which understands the future as uncertainty or possibility and arranges multiple elements of possible futures so that they can be acted

upon in the present (Amoore, 2013), thereby materialising a particular version of the future and limiting the horizon of potentiality.

In terms of analytical and methodological tools for understanding and challenging new calculative logics, techniques and practices, the authors in this volume examine the assumptions on which digital calculative devices are based (e.g., Birkbak and Carlsen; van Otterlo), and/or their effects, including discrimination (both old forms, engaged anew, and new forms, such as new digital divides), and violences related, *inter alia*, to personalisation and tracking (surveillance) and differentiation (profiling) (e.g., Deville and van der Velden; Widmer; van Otterlo; Nisa). They productively use metaphors to address assumptions, functions and effects, for example, with respect to the question, what role do algorithms play? They show that understanding them as filters (e.g., Widmer), mediators (e.g., Mackinnon), librarians (e.g., van Otterlo), public officials (e.g., Birkbak and Carlsen), gate-keepers, or judges can help elucidate the specificity of the ways in which algorithmic calculative devices have begun to govern different aspects of our lives. Furthermore, the contributors demonstrate the advantages of mapping elements of specific devices (e.g., Deville and van der Velden) and related assemblages (e.g., O'Grady); of comparing/contrasting different devices (involving experimentation) and imagining alternatives (e.g., Birkbak and Carlsen; van Otterlo)); of examining regimes of visibilities/invisibilities which digital calculative devices create, sustain and on which they depend (e.g., Deville and van der Velden; Leese; Nisa; Belcher; Widmer; Coleman), thereby revealing the limitations and challenging the neutrality and objectivity of digital calculative devices.

Cumulatively, the contributions to this volume provide an argument in favour of embracing the multiplicity of critiques at different levels, an argument informed by the diversity and complexity of new calculative logics, techniques and practices and the inevitable limitations of every specific form of critique.

Conclusion: toward a politics of algorithmic life

In June 2013, when the *Booz Allen Hamilton* contractor Edward Snowden revealed some of the extent of the analytical algorithms and data mining at work in NSA programmes such as PRISM, there were some aspects of his revelations that were not revelatory at all. Understood in terms of a set of digital calculative devices for identifying clusters and patterns in large volumes of unstructured data, the security techniques mirrored closely – and indeed drew upon technically – the processes already ubiquitous in business intelligence, marketing, in Google PageRank and Amazon web services, in text mining and sentiment analysis. Indeed, the development of algorithms for data mining has its origins in the ordinary and mundane spaces of supermarket shopping transactions data – it is only a short hop from calculating the confidence for the rule bread⟶mustard⟶sausages to calculating confidence scores (or risk scores) for telecoms meta data⟶travel to Istanbul⟶voice over internet protocol. Understood in this way, what is taking place in the realm of the sovereign deployment of algorithms in the service of security is but one element of a broader complex of how our algorithmic life governs and is governed. Perhaps one cannot simply respond to the political challenge of new calculative devices, then, by seeking to advocate ideas of privacy and information rights *vis-à-vis* the state and corporations. For the politics of algorithmic life dwells not only in the particular deployments of devices by powerful authorities, but also in what can be seen, what can be attended to or brought to attention, what can be decided on the basis of the algorithm (e.g., de Goede et al., 2014).

In many of the domains addressed in the chapters of this book, the calculative device is proffered by its designers as a solution to an otherwise difficult or even intractable problem of economic, social and political life – how to identify the 'insurgent', how to find love, how to best profit from the lending of money, which, according to Morozov (2013), represents a particular kind of technological 'solutionism'. In effect, the calculative device in an age of big data makes a particular kind of promise in the world – with all of this data available, beyond the reach and comprehension of human cognition, this device can order the data, make it readable and draw insights from it. Amid such promises to read, understand and calculate beyond the threshold of human attention, what happens to our capacity to decide and act, to relate to others and the world around us? What happens to politics, to a political life properly understood as arrangements that can never fully resolve the intractable difficulties of a fallible world? As the authors across the chapters of the book so vividly illustrate, digital devices do not merely act upon and through human subjects, changing the nature of associative life, enacting new forms of discrimination, but they also exceed their design, producing effects that are undeniably and irrevocably political.

Notes

1 In 2011, Watson used machine learning, statistical analysis and natural language processing to answer complex questions in the *Jeopardy!* Challenge, winning over the show's human contestants (IBM, no date).

2 This volume brings together selected contributions from the international academic conference *'Calculative Devices in the Digital Age'* held at Durham University 21–22 November 2013 within the framework of Prof. Louise Amoore's RCUK-funded research project *Securing against Future Events (SaFE): Pre-emption, Protocols and Publics* (ES/K000276/1).

3 Laura Poitras's documentary *Citizenfour* details the course of events precipitated by Edward Snowden's revealing of the data collection and analysis capabilities of the NSA and GCHQ, among other agencies. See also Harding (2014); Greenwald (2014).

4 Pertinently, a recent major US Report on big data cautioned that "[f]inding a correlation with big data techniques may not be an appropriate basis for predicting out-comes or behavior, or rendering judgments on individuals" (*Big Data: Seizing Opportunities, Preserving Values*, May 2014).

5 Insights drawn from observations at a *Tibco*® event, London, 2013.

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Part I

Algorithmic life

1

The Public and its Algorithms

Comparing and experimenting with calculated publics

Andreas Birkbak and Hjalmar Bang Carlsen

Introduction

One of the fascinating promises of the World Wide Web (web) is that it seems to hold the key to ordering its own 'messiness'. This is how Sergey Brin and Larry Page (1998) thought of their Google search engine: helping web users navigate the overwhelming amount of webpages by exploiting the fact that these sites refer to each other by means of hyperlinks, and interpreting this as a recommendation. Based on this logic, every page can be assigned a rank, making it possible to generate hierarchies in the form of Google search results, thereby "bringing order to the web" (Page et al., 1999). To achieve this, web algorithms, such as Google's PageRank, draw on methodologies found within the social sciences (Rieder, 2012). Sociological methodologies especially, and social science methodologies more generally, seem to be entering into a new relation with digital platforms that re-appropriate research methods to create hierarchies of relevance. And it is not only 'our methods' that are being redistributed and re-appropriated digitally (Marres, 2012c), but also political philosophies, that is, methods for envisioning a just social order, as will be argued below.

The idea that the solution to navigational difficulties posed by the web is to be found in the web itself has also been taken up within social research. One prominent example is Bruno Latour's MACOSPOL project (MApping Controversies in Science for POLitics), where the disorientation associated with the web is to be turned into an opportunity for mapping issues:

> Why mapping? It is possible we think, that the same tools, the same media, the technology of the web, which produced this sea of information, which is at first so disorienting, is also the source of a technology which allows us to do the mapping of it. It is exactly the same technology that provided the problem that should also provide the solution to the problem.
>
> *(Latour, 2010, video)*

What Latour points to here is the way in which, for his purposes, the web simultaneously generates a problem and a possible solution. Latour argues that, instead of adding something external to the web, the key is to be found through the web itself. We identify a similar dynamic of a simultaneous creation of problem and solution with respect to web algorithms, but the other way around: web algorithms position themselves as first and foremost offering solutions, while their corresponding construction of the problem, to which they are the solution, is less explicated. Still, what happens in practice is that Google crawls the web in order to discover and index new websites, with the result that Google searches return thousands of hits, making its hierarchy-generating PageRank algorithm seem indispensable. With devices like Facebook and Twitter, this dynamic is made somewhat more explicit. These so-called 'social media' constantly invite their users to 'be social' by submitting new content, which results in a stream of posts, tweets and 'likes' that no human user can follow in its 'raw' version. The work of algorithms seems absolutely necessary to order this 'mess' and deliver a useful Facebook newsfeed and point to top

Twitter trends.

The focus of this chapter is the algorithmic methods that web services deploy to order their own disorder. Like all ordering methods, web algorithms enact the social in specific ways. In this chapter, we read the calculative devices of Google, Facebook and Twitter as sociologies and as political philosophies. We raise the question of what it means when Google (2014b) claims that "democracy on the web works" and Twitter (2014) says that it "connects the planet to a global conversation". What kinds of publics are enacted with these omnipresent calculative devices? And how might we distance ourselves from their positioning as self-evident and indispensable?

We examine these questions in three moves. First, we argue that the important task is to clarify, rather than critique, the political philosophies of contemporary calculative devices. We base this argument on a pragmatist understanding of publics as always in need of orientation in uncertain situations, as developed by Lippmann (1925) and Dewey (1927) and discussed further immediately below. Second, we pursue the ambition of problematising the calculative devices of Google, Facebook and Twitter. We do so by simplifying and contrasting the 'political philosophies' that can be derived from their algorithmic assumptions, and use these caricatures on a dataset that is not native to any of them. Third, we take advantage of the pluralistic space of calculated publics that has now been deployed in order to think about how it could have been otherwise. More specifically, we propose two alternative calculative approaches as an intervention to supplement existing calculative publics.

The public and its algorithms

Following a pragmatist understanding, publics always need means for orienting themselves. This is what Walter Lippmann (1925) called the "coarse signs", with which an always busy and ignorant public can find ways to approach an issue. As Dewey (1927) reminds us, one way in which a public might help itself is by appointing public officials to produce such signs that reduce the amount of uncertainty that has to be dealt with. Recognising this pragmatic need is helpful for avoiding a premature critical stance on web algorithms. Examining such algorithms as a new kind of 'public officials' means appreciating their value as the producers of coarse signs with which publics can orient themselves. However, such signs are only useful in so far as they are meaningful, which raises the question of what kinds of publics web algorithms assume and produce. Put differently, if web algorithms constitute a new sort of public officials, by what kind of public would these officials be employed? What public would find the signs produced by Google, Facebook or Twitter meaningful, useful and legitimate?

Answering this question amounts to a clarification of the world in which each web algorithm seems self-evident and indispensable. Here, the work of Boltanski and Thévenot (2006) offers valuable guidance by pointing out that public orderings always come with justifications. There is not only a practical need for orderings, there is also a need for being able to make apparent a world in which these orderings can be justified. Discussing contemporary web algorithm in terms of their production of 'calculated publics' thus has the advantage of explicating how such algorithms are simultaneously descriptive and prescriptive (see also Rieder, 2012). Drawing on Boltanski and Thévenot (2006), the algorithmic devices of Google, Facebook and Twitter should be examined as offering situated visions of not simply 'the public', but 'the just public'. The reward of such a move, we hold, is a heightened sensitivity to how calculative devices not only explicitly generate the worlds they claim to describe, but also the moral trope from which we are to judge and act on this world, which is a crucial part of understanding the politics of algorithms. By 'the public' we simply mean a public that has been filtered and ordered as to produce a legitimate vision of the public. This has importance in so far as such a vision – always situated in a specific 'world' – offers the means of navigation in a critical situation, making it possible to identify, consult, oppose or support those that matter in relation to a given issue.

Following Boltanski and Thévenot, soliciting these worlds requires a positive, even deliberately naive, analysis that does not rush in with critiques external to these worlds. Instead, one must attend to internal references to what constitutes 'truth' and what it means to contribute to 'the common good' in each world. The advantage of such an approach, for us, is that it allows us to 'politicise' web algorithms 'from the inside out'. By taking these devices seriously as ordering practices that care about justifying themselves,

we reach a position from which the political philosophies that come with web algorithms can be deployed on their own terms. Against the backdrop of a pluralism of calculative publics, it becomes easier, we hope, to formulate positive alternatives. In other words, we play with the idea that to politicise contemporary web algorithms, one does not have to reveal 'true' economic interests hidden behind rhetoric of democracy and human development (Mager, 2012; Vaidhyanathan, 2011). Instead, there is an option of taking this rhetoric seriously, and using it actively to create political differences, which has the advantage of explicating the several distinct ways in which orderings of web data are being done and justified in practice.

Three calculated publics and their consequences

In what follows, first, we combine a reading of the algorithms of Google, Facebook and Twitter with an examination of how they justify their algorithmic orderings. We do so in order to identify the political philosophy, or the vision of the just public, embedded in each device. Second, we caricature these visions in a way that maximises the contrast between them and makes them easy to operationalise. We use these caricatures to illustrate the consequences of each political philosophy on a small dataset of economics research papers selected for the purpose. Illustrating the consequences of calculative devices in this staged way, serves to open a pluralistic field of workable orderings, whose politics do not need to be unveiled or undercut. The point is to avoid the assumption, implicit in a strong critical stance, that ordering can somehow be done without. Instead, we wish to highlight the work it takes to produce orderings, which also means appreciating what a daunting task it would be to replace the orderings of contemporary web algorithms with something else entirely. The advantage of such an appreciation is a more positive description of existing devices that opens for a specification of what descriptive/prescriptive work these devices do.

Google

> Google's mission is to organize the world's information and make it universally accessible and useful.
>
> *(Google, 2014a)*

This dual ambition of being both universal and useful poses the challenge of being inclusive and exclusive at the same time, which is indeed a requirement for any just vision of the public. According to Boltanski and Thévenot (2006), any order of worth must be accompanied by an argument for how its hierarchisations benefits everyone. In Google's case, the attempt to "bring order to the web" is based on the observation that "democracy on the web works", as we have already mentioned. This is 'the truth' that makes the common good of universal and useful information possible, and it is the principle of equivalence that is built into the PageRank algorithm: democracy 'works' in the specific sense that running a continuous vote among web sites results in an algorithmic ordering that is both just and useful. In the same way as a survey enacts an opinionated person (Osborne and Rose, 1999), Google can be said to enact an opinionated website. Crucially, this mechanism is not just the tyranny of the majority, because Google's algorithm assigns different weights to different 'voters', as the name 'PageRank' indicates. This arguably introduces a conservative flavour in the political philosophy of the algorithm. Older websites have had more chances to accumulate hyperlinks pointing to them, something that Google interprets as a sign of 'wisdom' and values with a higher PageRank, that is, a vote that counts more. As such, Google can be said to show a certain respect for the

'elders', with arguably positive and negative implications. Google may be granted to 'bring order', but this order has been pointed out to come at the price of 'winner takes all' effects (Marres, 2012c). We suggest that the caricature of this vision of the just public, which will allow us to operationalise it for the purpose of ordering a dataset of research papers, is the following rule: articles vote for each other through links (citations), and votes from articles that have received many links themselves (that have been cited more), count more.

Facebook

At Facebook (2014), they seek to: "give people the power to share and make the world more open and connected". Here we also find an indication of a common good and a truth about how to achieve it. The common good is a world that is open and connected. The truth is that this common good is produced when people are given the power to share. Contrary to Google, the ambition is not to produce a universal ordering, but rather a multitude of situated orderings based on personal connections and privileged sharing. This is pursued in practice by Facebook's newsfeed, where relevance is based on the so-called 'EdgeRank' algorithm. This algorithm qualifies and prioritises content based on evaluations of previous interactions and connections ('edges'), such as posts, comments, and 'likes' from friends. The principle that justifies this hierarchy is *recent engagement* (Birkbak and Carlsen, 2015), so connections in which users have already been previously engaged should be prioritised in this ordering. In order to emphasise this feature of the Facebook vision of the just public, we arrive at the following operationalisation: 'likes' (citations) from friends (co-authors) are worth much more than other citations.

Twitter

The third calculative device under consideration here is Twitter, which deploys its Twitter Trends algorithm as part of its mission to create a "global conversation". What the Twitter Trends algorithm does is trying to identify the most important topics currently being discussed across Twitter. This focus on globalising is more akin to Google's mission than Facebook's, but contrary to Google's preference for authoritative voices, Twitter values a diversity of actors. As one Twitter engineer has formulated it, "[t]rends isn't just about volume of a term but also the diversity of people and tweets about a term" (Elman, 2010, comment #11619). In the world of Twitter, to paraphrase Boltanski and Thévenot (2006: 74–78), the 'worth' of events is based on whether they unite people who are not already friends. This is not only different from Google, but also from Facebook, whose valuation of personal ties is inversed by Twitter. The Twitter Trends algorithm sees friendship ties as a negative indicator of 'true' trends. Based on this philosophy, the just public is a diverse one, gathered around political issues rather than around social connections (Facebook) or

respected elders (Google). We operationalise this Twitter vision with the rule that links (citations) from non-friends (non-co-authors) are worth much more.

Having sketched these three principles for ordering the just public, our next step is to experiment with their consequences in practice. What happens if we take these three algorithmic philosophies out of the world in which they seem indispensable? How does this contribute to a clarification of their consequences and the imagination of alternatives? The small practical experiment we present here consists of constructing an order of worth among 194 economics research papers related to the financial crisis – a dataset that was collected and examined as part of a different project (Carlsen). The articles are all from top economic journals (based on impact factor), from between 1993 and 2013, and all have 'crisis' in either their abstract or keywords. Apart from availability, this dataset has additional advantage of being 'non-native' to all three of the calculative devices under consideration. Scientific citation data thus offers an opportunity to experiment with the three principles we have extracted on a relatively equal footing.

The results of the experiment are shown in the Table 1.1, where the top five papers are ordered in lists, similar to the ways in which Google, Facebook and Twitter produce lists of content.

Table 1.1 Top five articles based on the ordering principles derived from Google, Facebook and Twitter

	Google	*Facebook*	*Twitter*
1	Kaminsky and Reinhardt (1999)	Kaminsky and Reinhardt (1999)	Kaminsky and Reinhardt (1999)
2	Johnson et al. (2000)	Johnson et al. (2000)	Johnson et al. (2000)
3	Cole and Kehoe (2000)	Mitton (2002)	Mitton (2002)
4	Peek and Rosengren (2000)	Angeletos et al. (2006)	Schneider and Tornell (2004)
5	Mitton (2002)	Schneider and Tornell (2004)	Cole and Kehoe (2000)

The results of this small experiment reveal both similarities and differences between the three principles for orchestrating publics. Given that the data set is quite small, and contains relatively few co-author relationships ('friends'), it is not surprising that the top two papers are the same across the board. Apart from these 'agreements', there are at least two noteworthy differences in the orderings. First, we note that Twitter and Facebook's lists both contain a paper from 2004 that is not on Google's top five. Compared to Google's list, which contains the oldest set of papers, this is a relatively recent publication, which might not have had enough time to win authority in the (caricatured) 'eyes' of Google, but which is prioritised by the 'social' media of Twitter and Facebook that value qualities other than authority. Indeed, these orderings also assign a higher rank to Mitton's paper from 2002, which only barely makes it into Google's top five.

Second, we also notice a difference between Facebook and Twitter in that Facebook

includes an even more recent paper, namely the one from 2006. In our reading of Facebook's philosophy, the methodological guideline that came to the fore was that of valuing previous interaction. The position of the 2006 paper in the Facebook's top five suggests that it has been cited by some of the author's previous co-authors. The fact that this recent paper made it into the Facebook top five points to a possible consequence of this particular ordering principle, namely, that relatively recent events can be given high priority in the specific settings if they relate to previous activity. In comparison, it might take a longer period of time to 'impress' Google with citations from works that themselves are highly cited. Facebook's orderings thus offer opportunities for 'shortcuts' through network connections.

Our experiment shows that the different ordering principles – or political philosophies – of the calculative devices of Google, Facebook and Twitter have different consequences in practice. This explication is useful for thinking about what kind of world we enter when we use these devices. Google seems to enact a more 'global' and conservative vision of the just public, while Facebook and Twitter offers more volatile visions, based on the presence and absence of 'local' connections, respectively. The fact that all three devices are widely used suggests that the web is not easily described as home to some kind of singular 'calculative logic'. Rather, prominent web services provide fundamentally different visions of 'the just public'. What we have tried to show is that these visions are not just the results of obscure and proprietary algorithms, but explicitly justified according to markedly different principles.

Perhaps most importantly, the demonstration of this plurality of 'web worlds' is also an opportunity to start imagining alternatives. What might another vision of the just public look like? One way to start thinking about this is to question the fact that Google, Facebook and Twitter 'agree' on the same two papers as the top ones, based on different ways of weighing citations. How might we intervene to step out of this world of citation aggregation?

Alternative calculated publics

Our suggestion is that the advantage of identifying and testing the ordering principles of these web algorithms is not only that it becomes clear that they constitute specific interventions with various consequences. The advantage is also that it might open up a space for additional interventions by researchers. One intervention, well-known in Science and Technology Studies, is: "to insist on the 'un-boundedness of the setting'" (Marres, 2012a: 25). Given the practical need for publics to orient themselves in problematic situations, it does not suffice to raise this critique from 'the outside'. Rather, the ambition must be to intervene by devising working alternatives that supplement existing ones. What could it mean in practice to insist on the unboundedness of the setting? One way to break with the setting produced by web algorithms could be to go beyond the notion that the number of citations is the fundamental variable. One of us (Birkbak) is currently doing research on newspapers as public-generating devices, a setting in which a radically different vision of the just public can be found. In a newspaper setting, the editing work related to opinion letters and debate pages is guided by a valuation of neither friendship, nor votes or issue-connections, but *conflict*. Indeed, editors constantly look for sharp, well-defined and 'juicy' lines of disagreement in the opinion letters they receive.

What might a conflict-oriented algorithm look like? In the network visualisation program, *Gephi*, the so-called *'ForceAtlas'* algorithm is used to spatialise networks so that they can be investigated qualitatively. *ForceAtlas* operates according to a principle of repulsion and attraction, where connected nodes come closer and non-connected nodes repulse (Jacomy et al., 2014). Thus, it calculates publics in a way that foregrounds different clusters, instead of relying on counting and weighing relations, as Google, Facebook and Twitter each do in their own way. This is an alternative, more agonistic, calculative strategy that we as social researchers might use to inform our intervention. Figure 1.1 is a visualisation of the citation dataset as a network spatialised with the *ForceAtlas* algorithm in *Gephi*.

In the visualisation shown in Figure 1.1, the papers appearing in the three lists of Google, Facebook and Twitter are coloured in order to highlight the contrast between these approaches and the *ForceAtlas* approach. The nodes are sized according to the number of times they have been cited. Each citation is represented by a directed edge between two nodes. In the upper left corner of the visualisation, we have coloured a node black because it represents an interesting paper in a cluster that is not connected to the majority of the papers. The paper is about de-growth, and it has not been 'seen' by the lists generated using the principles of Google, Facebook and Twitter. Here we have another conversation, which stands out exactly because it is disconnected. This is a useful illustration of the consequences of the *ForceAtlas* algorithm, which justifies itself by insisting on the unboundedness of the setting. The insistence on visual representation on two-dimensional

maps, instead of one-dimensional lists that comes with algorithms like *ForceAtlas*, renders relevance as source of uncertainty rather than a matter that is already decided upon, justified and closed.

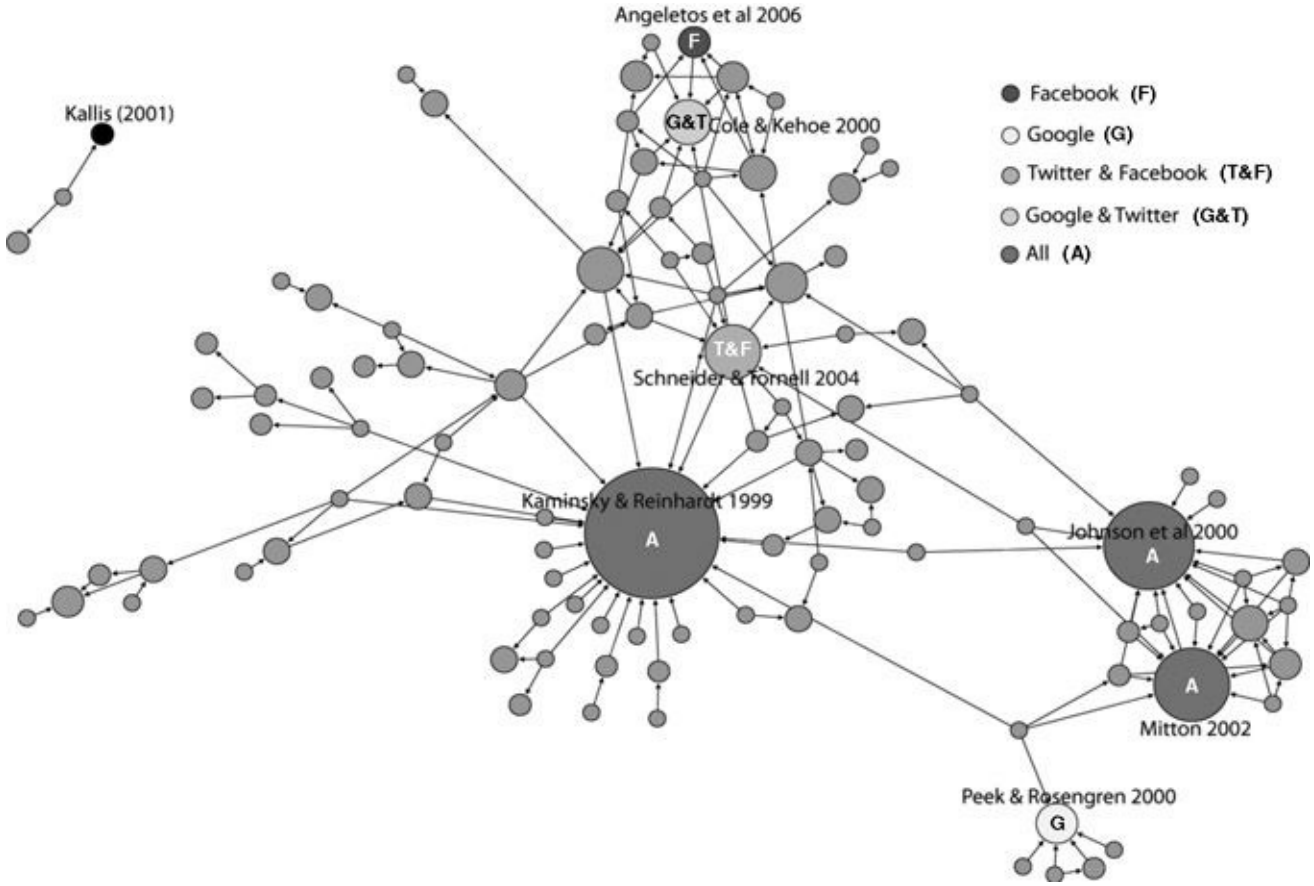

Figure 1.1 Citations in the dataset visualised with *ForceAtlas* in *Gephi*

Following Marres (2012b), we could say that *ForceAtlas* introduces a 'strong' topological approach compared to the 'weak' topologies of Google, Facebook and Twitter. These latter calculative devices all create and order the world in terms of networks, but they also continue to rely on various kinds of 'popularity contests', as we have indicated above. The web algorithms produce a weak topology in the sense that their production of networks is not entirely committed to a 'flattening' of the world. Some entities still rise above others due to their accumulation of likes, retweets, links, or citations. In the spatialisation of *ForceAtlas*, on the other hand, we encounter an ordering where entities stand out not so much because they are popular among certain sets of actors, but because they are different. When some papers challenge larger clusters by generating a distance to them, an empty space in the map appears that invites questions about antagonism and exclusion. This comes across as a 'stronger' topology, since what is foregrounded is the qualitative arrangement of papers in relation to each other rather than the quantitative accumulation of citations.

The alternative vision of the just public operationalised with *ForceAtlas* continues to rely on citation data, however. We still rely on 'social' indicators of relevance (Marres, 2012c). Might we also conceive of an intervention that challenges this framing of the public? Citing someone (or linking to a homepage, or retweeting, or 'liking' someone's post on

Facebook) is not a transparent action in terms its motivations. In an age of digital devices, there is an abundance of computational power that allows us to engage signs more complex than links or citations. What if we focus not on the relations that are already there as relations, but take into account other parts of the texts, using co-occurrence of words as an ordering principle? This might be a fifth vision of a just public, based on the argument that the public must engage with substantial dynamics, with content that is on the move. As Marres and others have proposed (Marres and Weltevrede, 2013; Marres, 2012c), drawing on Callon et al. (1983), we might focus on the *liveliness* of content. Liveliness is understood here as opposed to mere popularity in that it does not value a term because it is 'popular', but according to whether it enters into new relations. This creates a new way of ordering the social, one that brings forth the content that is 'happening'. Such an ordering corresponds well with the slogan of actor-network theory that one should focus on the social when it is alive and creative, because the social is, in fact, a movement (Latour, 2005).

We have tried to operationalise this idea of lively content by creating our own algorithm that focuses on whether articles' keywords enter into to new relations. In this operationalisation, a relation is made between two keywords if they co-occur in the same article. What our calculative device then does is summarise all the relations every keyword has entered into in a given year and compare this sum across all years in the relevant time period. The keywords that are a part of a relatively high amount of new relations are assigned a higher score, and these scores are then used to give all the articles a liveliness score based upon how 'lively' their keywords are. The results of this algorithmic ordering are shown as another top five in Table 1.2. Each of the top five articles is accompanied by its set of keywords to give the reader an idea about what is going on.

Table 1.2 Top five articles based on the 'liveliness' of their keywords

	Articles	*Keywords*
1	Galindo and Malony (2002)	balance-of-payments crises; currency crises; price
2	Aghion et al. (2004)	microeconomic adjustments; currency crises; monetary-policy; intermediation; constraints; inflows; cycles; shocks; 1990s; model
3	Angeletos and Wering (2006)	currency crises; bank runs; coordination; equilibrium; liquidity; crashes; models; rates; debt
4	Allen and Gale (2004)	balance-of-payments crises; bank runs; liquidity creation; deposit insurance; model; equilibrium; information; fragility; panics; risk
5	Farhi and Tirole (2012)	monetary-policy; bank runs; liquidity; inconsistency; equilibrium; discretion; failures; private; crises; rules

The two 'liveliest' keywords in our dataset is 'balance-of-payment crises' and 'currency crises', which means that they are the keywords that co-occur with the largest numbers of new keywords each year. As shown in Table 1.2, the presence of these keywords has helped

the entire first four articles rise to the top in our liveliness hierarchy. The top article includes both of these keywords, while the fifth article that only just made it into the top five is the only one that does not mobilise any of the two most 'lively' keywords. The liveliness of terms like 'balance-of-payment crises' and 'currency crises' might indicate how the Asian economic crisis in the late nineties sparked a great variety of ways in which economic crisis was framed. This is not at all certain, however, and, like all other algorithmic methods, this one needs constant qualitative judgement to refine its methodology (Muniesa, 2004). Our point here is that 'the algorithmic' is something social scientists can explore and take seriously as a way of actively engaging in the politics of methodologies.

The first and very apparent difference between this liveliness-oriented ordering and the previous orderings is that none of the articles are the same as the ones prioritised by the methodologies derived from Google, Twitter, and Facebook. As such, the liveliness algorithm offers a radical reorganisation of relevance, and a clear break from the 'popularity contest' of citation counts. This difference also helps to show how algorithms can be agnostic, not only in their principles, but also in their outcomes. What we have arrived at with this co-word analysis is an indication that the most cited articles might not at all be the ones in which the most is 'happening' in terms of movement between different 'post-social' relationships (Marres, 2012c). Here is a second way, then, in which we as social researchers might intervene in the pluralistic space of algorithmic orderings. Table 1.3 presents the five alternatives that have been discussed.

Table 1.3 Summary of the calculative devices and their respective ordering principles

Calculative device	*Ordering principle*
Google	Authority
Facebook	Sociality
Twitter	Issue-orientation
ForceAtlas	Antagonism
Co-word algorithm	'Liveliness'

Needless to say, this list is not exhaustive. On the contrary, these experiments have served to show that algorithms offer a plurality of ways for us to orient ourselves in 'messy' environments, and that these orderings come with justifications that, if taken seriously, explicate the world and the just vision of the public enacted by each algorithm. The value of this exercise, in other words, is that it has taken us some way in answering the question of what kinds of publics various calculative devices serve as public officials for, through actively politicising these algorithms. We have tried to do this in a 'positive' way, where we have followed along with the justifications that are internal to the calculative devices under scrutiny, thus explicating rather than critiquing their politics. This is something social scientists can contribute to by engaging with the current rise of digital

methods. As Rieder (2012: 11) concludes: “We risk missing a genuinely political moment if we lose sight of how software can sometimes make it astonishingly *easy* to do things differently”. By experimenting with the alternative algorithmic orderings of *ForceAtlas* and co-word analysis, we hope to have gone some way in demonstrating how this can be true for digital social science methods and the publics they generate.

Conclusion

In this chapter, we have tried to unsettle the ways in which the web algorithms of Google, Facebook and Twitter position themselves as self-evident and indispensable. Our strategy has been to articulate and contrast the different visions of the just public embedded in these calculative devices. The main point was not to suggest that we would be better off without these devices. The formation of publics always come with a need to orient itself with respect to a problem of relevance (Marres, 2012a), which is the inherently challenging process of simultaneously articulating an issue and the public capable of solving it. We have experimented with the idea that this is what web algorithms do, that is, that they do work as public officials. By offering automated orderings, web algorithms simultaneously prioritise issues and delineate the corresponding publics.

We have focused on how three of the most prominent web algorithms order publics. More specifically, we articulated their ordering principles 'from the inside out', in a way that made it possible to see contrasts and start imagining alternatives. This was achieved by paying attention not only to how the algorithms work, but also to how these calculative devices justify themselves as part of their framing the problem that they claim to be solving. These justifications offered a vantage point for identifying the political philosophy of each device. We extracted and experimented with these philosophies in a relatively 'quick and dirty' way, which was not supposed to be exhaustive, but rather to serve as a heuristic through which to open a space in which it is possible to make more-than-critical interventions. In the last section of the chapter, two such interventions were proposed, the first of which served to go beyond the focus on popularity, and the second of which went further beyond the focus on the reputational logic of citations, 'likes', retweets, and links. In a digital age, where the orderings of web algorithms play prominent roles for how we navigate our environments, it is a crucial task to flesh out the worlds that these calculative devices create for us, to experiment with their consequences, and to suggest how in practice there could be other relationships between the public and its algorithms.

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2

The Libraryness of Calculative Devices

Artificially intelligent librarians and their impact on information consumption

Martijn van Otterlo

Introduction

Physical books are colourful objects: "[r]egardless of how books are grouped, they do furnish a room" (Petroski, 1999: 252). However, libraries are not formed randomly, but it is the owner's *intention* to accumulate *knowledge* on particular topics that forms them. Libraries are *deliberate* acts: each book contributes something, and all books together form a unique knowledge base, selected, arranged and ordered by a *librarian,* who has, in essence, only two main tasks.

The first task is the *selection* of books. The librarian brings together a set of books, through buying, gifting, trading and so on. The librarian's interests, among those of a wider community of scholars or readers, determine *why* books get selected. The librarian's second task is to *order* the books according to some criteria, and physically *arrange* them according to that order. Several formal systems have been developed in history to do so. For most personal libraries, ordering is a constant activity due to limited physical space, an expanding collection of books, and changing interests. Rearranging books (e.g., by subject) is a fun but tedious thing to do, and, in the end, the order is never perfectly right (e.g., does *'Alice in Wonderland'* go with science or with novels?), and often physical space is lacking in the wrong places (e.g., subjects spanning exactly one full shelf plus three books: where to put these then?). In general, the order of the library depends on the *physical spaces* in which it resides. This includes the physical shelves (see Petroski, 1999), but also the library's *building*.

What a famous book hunt teaches us about calculative devices

I frame information consumption activities, such as reading or searching on the web, as *traversing a (digital) library*. By way of illustration, consider the famous story *'The Name of the Rose'* by Umberto Eco (1980), in which, beneath the plot of a murder mystery, a grand story about knowledge unfolds in the context of a cloister library. The main characters find in the blind librarian Jorge von Burgos a notable adversary, who tries to keep them from finding a particular book. They find themselves in an unknown library, with hidden passages, hidden books, and with an order unknown to them. The particular arrangement of books was beyond their capacity to navigate the space and locate the specific text. All of these obstacles were introduced by the 'evil' librarian with a purpose: to control what others read and especially what they should *not* read. The library is a source of knowledge, but it was the librarian who decided the terms of its use.

In addition to physical libraries, which still exist of course, many novel, digital libraries have arisen in which we can search for knowledge. For example, *Google Books*, containing millions of books, can be seen as a *digital library,* where books can be *ordered on the fly* according to many possible criteria. Whereas *Google Books* is somewhat close to a physical library, we can also talk about general web search as library traversal: one starts at some point and, based on the order of information sources on the web (governed by the search engine), we are given an *ordered* set of items we can visit (the search results). Just like in Eco's story, it is essentially the librarian who gets to determine how our traversal through his library comes about. But, unlike in the novel, digital libraries have digital librarians; pieces of software, or, *algorithms*. Algorithms govern the library via automated selecting and ordering. Digital librarians are *calculative devices* that learn from the information-seeking behaviour of many individuals to instantly *rearrange* the library for a specific individual and her current information needs. Modern search engines *personalise* search results based on previous behaviour, general knowledge and statistical information about many other users. Understanding that particular arrangement of material, and how this reordering happens, is vital for appreciating how much power algorithms have obtained in our society.

To understand how algorithms function as keepers of digital information, one may study algorithms as things with capacities themselves. An alternative developed in this chapter is to exploit our pre-existing knowledge of physical libraries through the use of a metaphor that links it to new contexts. Metaphors are *thought tools*[1] and vital in framing difficult problems to understand them in new ways. Well-known examples from the privacy literature are Orwell's '*Big Brother'* and Bentham's '*Panopticon'*. Here, I introduce a 'library metaphor' to characterise modern information consumption, which I conceive as a traversal of a digital library governed by a digital librarian.

The chapter proceeds as follows. First, I briefly review some aspects of the overarching topic of privacy as control over information, in which our metaphor finds its place. I then outline fundamental aspects of physical, digital and universal libraries, before moving on to discuss the role and power of digital librarians, mapping out some insights on how to better study them. Overall the chapter proposes a new means of characterising and understanding the work of algorithms in our world.

Privacy and control over information

The ideas I develop here contribute to a wide-ranging contemporary debate on algorithms, surveillance, privacy and control in digital worlds (e.g., Vaidhyanathan, 2011; Bozdag, 2013; de Vries, 2013; van Otterlo, 2013, 2014). It is possible to distinguish three types of changes in control over information: *access*, *prediction* and *manipulation.*

The first type of control centres on *access*. Currently much of the privacy debate is about what Google, Facebook, the NSA and others know about us. Framed as 'big data', information is gathered everywhere, ranging from medical records, to public transport chip cards, and to smart energy meters. Long before the infamous *"don't be evil"* slogan by Google, Warner and Stone (1970: 146) warned us to:

> "not be naive about it": "Anyone who has entered into a hire-purchase transaction ... should nowadays expect both the personal data he supplied in his application, and the information about his reliability in making the repayments, to be widely available".

Roughly forty years later, information is available in digital form, and privacy violations and abuse of data are common. Data is a commodity and is traded on a large scale. Control over information here is essentially about *control of access*: who-can-see-which-information.

The second type of control arises when intelligent algorithms are employed, such as with *machine learning* (Domingos, 2012), or more generally, *artificial intelligence* (AI) (Nilsson, 2010).

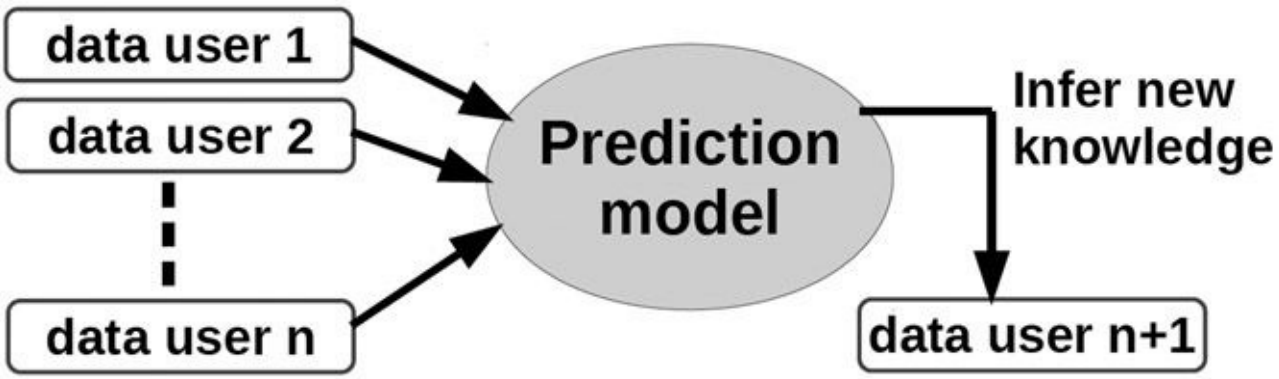

Figure 2.1 Statistical prediction models

Such algorithms couple modern *statistical methods* with powerful *knowledge representation* languages to generate rich *prediction models* from data and allow for the generation of *new* or *inferred* knowledge. Such models are based on information about many individuals, and they can be used to predict traits for specific individuals. Going beyond the data alone, the s*econdary use* of data was aptly termed by Amoore (2011) "data derivatives". For example, models could (probabilistically) predict whether I would buy a particular book, based on previous purchases and similarity measures between books that are 'alike'. Elsewhere (van Otterlo, 2013), I have discussed techniques for the generation of

models from data. These may contain a *generalised* rule 'if a person is tall, it is more likely that it is a male', which represents a typical *pattern* in the data. Such a rule may not predict well for *every* individual, but it does predict well *on average*. In addition, the rule may be used to predict (a possibly *unobserved* feature) 'male' from (an *observed* feature) 'tall'. Models can be utilised to infer more about a specific individual and to statistically predict the behaviour of individuals. For example, Schwartz et al. (2013) predict features such as gender, age and location of people based on their language use, whereas Kosinski et al. (2013) predict such traits from Facebook 'likes'. Many forms of *bias* are present when generating the models from data, which determine how accurate or confident predictions are.

The third type of control over information deals with the *use* of prediction models for a purpose, such as surveillance or commercial profit.

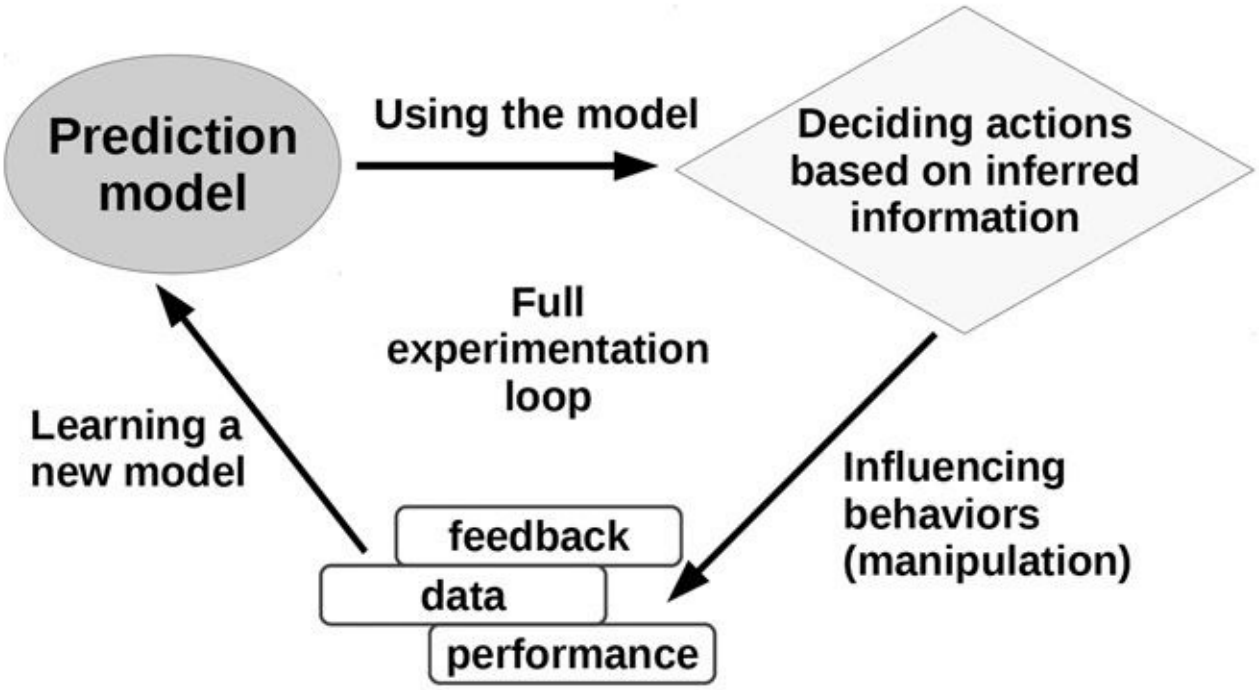

Figure 2.2 Feedback loops and experimentation

I have outlined (van Otterlo, 2014) how modern computational techniques give rise to communities governed by the principles of *behavioural engineering* as described in '*Walden Two*' by the psychologist B.F. Skinner. The idea is simple, yet very powerful: given a prediction model of individual behaviour, a company or government can *exploit* that model to *manipulate* the behaviour of large groups of individuals. As claimed by Warner and Stone (1970: 124):

> Give the administrator in government or business the use of an integrated national population file … and you provide him with a powerful tool for interference in private lives, to manipulate, to sell more, to condition, to coerce.

Currently, based on the countless ways people are *measured* in their daily activities, algorithms can automatically build prediction models to do just that. Since this happens in a statistical manner, the manipulation of individuals may be incorrect or inaccurate but, on average, at the level of populations, manipulations can be understood as 'error tolerant' and

successful. Good examples of the exploitation of models are supermarket loyalty cards and modern political campaigns, where social media is used to target specific sub-populations. Such situations also highlight a possibility for full *feedback loops* (van Otterlo, 2009), in which data collection, model generation and model exploitation are executed in sequence and indefinitely, enabling algorithms to *experiment* with different settings to see which (kinds of) manipulations work best. For example, many websites present different versions to different users to experiment with layout and information presentation, in order to maximise profits.

The three types of changes I have discussed are ordered by how strong algorithms influence the information environment of a particular individual. Where, in the first case, information is merely gathered, the second deals with using that information for prediction and, due to that, treating an individual in new ways. One step further, the third setting concerns the direct, intentional manipulation of the information environment of an individual and provides the general setting for what follows.

Libraries as ordered spaces of information

In this section, I discuss two types of libraries, physical and universal, which form two distinct ways to view and organise a collection of data or information sources.

Figure 2.3 A librarian in: (left) an ordered, physical library; and (right) an unordered, digital or universal library

Physical libraries

Now, what exactly *is* a library? According to '*Librarians' Glossary'* by Harrod (1977: 487), a library is (at least) two things. First, it is a "collection of books and other literary material kept for reading, study and consultation". In other words, it is a *selection* of books. Secondly, a library is "a place, building, room or rooms set apart for the keeping and use of a collection of books". Thus, the first meaning focuses on the books, whereas the second is concerned with the physical infrastructure. A library is not necessarily and only its books, and vice versa. The person who puts order in the library is the librarian:

> one who has to care of a library and its contents, selecting the books, documents and non-book materials which comprise its stock, and providing information and loan services to meet the needs of its users.
>
> *(Harrod, 1977: 486–487)*

A definition of book selection is – "the process of choosing books for inclusion in a library with a view to providing a balanced increase to the stock" (129). The librarian needs to *catalogue* all information in the library, which means to – compile a list of documents according to a set of rules so as to enable the consulter to know what items are available, and from the class number, call number, or other means of identification, where they may be found.

Since the library consists of rooms as well as book-holders (e.g., shelves), many possibilities exist to distribute physical books among physical places.

The physical ordering is part of the *design* of a library, basically a subfield of *architecture* (Roth, 2011). Buildings, including libraries, can be seen as *graph structures,*

where the nodes are rooms and the connections are corridors and passages. Edwards (2009) extensively surveys many (functional) design aspects for modern libraries. Physical libraries consist of rooms with bookshelves filled with books. The library's books are distributed over the physical space *according to the order,* and the *catalogue* is required to *find* and *locate* any book in the physical space. A library user traverses the corridors and the rooms, searching for specific books in the catalogue, or browsing to find interesting books, guided by the physical order in the collection. The *logical ordering* of the books according to a catalogue is orthogonal to the physical distribution over the library and deals with how to form subgroups of books that "belong together", for example, based on *features* such as author's name, title, subject, size, colour, and so on (Edwards, 2009: 106–111; Petroski,1999: appendix). The physical dimension prevents us from rearranging every day, rendering the order only slowly varying. Shelves generally do not align well with any of the feature-based orderings: almost certainly all books according to one feature will not *exactly* fill a number of shelves, leaving room for books of a different category. A *catalogue* of books ordered by some feature(s) is still in need of a reference system that tells you *where* the book can be found in some list, index or catalogue, may be found in the physical location of a room and a shelf. A simple idea (see Eco's preface to Höfer, 2005) is to use a four-digit code for books such as 32-2-4-13, where the first number specifies the room, the second the wall, the third the shelf, and the fourth the book itself. A formal, general system is the widely used *Dewey-decimal system* that subdivides the collection by subject area, such as philosophy and religion. When new books come in, shelves get rearranged, and books may get new (sub)classifications. The librarian is responsible for keeping the physical books arranged according to the order.

Universal libraries

A Universal library essentially is a library containing all knowledge, or alternatively, *all possible books.* As White (2008) and Nerdinger (2011b) both extensively describe, the idea of a universal library is an old one. Over two millennia ago, the Ptolemites started the famous library of Alexandria, possibly the first universal library. Universal here means *as complete as currently possible.* In the physical reality, this means that physical copies of all books need to be assembled at the same (geographical) location. Others have envisioned similar libraries, such as Gessner (1516–1565) (*Bibliotheca Universalis*), but also Naudee (1627) and Bacon (1620). Most writers and thinkers about universal libraries have a vision in which *all knowledge is gathered and organised* to the aid of mankind. Eco's library described in the introductory section was such a library. The physical nature of books and buildings made all of the approaches towards universal libraries in history rather *local.* That is, a library would be *the* place of knowledge, literally, since it would be an actual *place* where all the knowledge, books, the librarian and the catalogue would reside.

A second type of universal library is the one we find mostly as an idea in fiction. Borges'

(1941) '*The Library of Babel*[2] describes the very idea of an imaginary library of *all* possible books. The only requirement is that each book has the same number of pages (410), lines (40/page) and characters (80/line). He also described exactly how the library building itself would look, composed of hexagonal rooms, each connected to two other rooms each holding four walls of five shelves each, each containing 32 books. This library would contain all books known to man, but that is only the beginning. It would also contain all books that were *never* written, and books that are currently *being written*. It would also contain a book that is exactly like Eco's '*The Name of the Rose'*, but in which the library survives the fire. It would simultaneously hold a copy in which the story ends with Eco himself appearing as the fire brigade commander and putting out the fire. *Every book* one can think of would be in the library, in every language thinkable. This also means that a large majority of books would contain just nonsense: there will be many books containing mostly the character 'a' and, for each existing novel, there would be copies in the library with any combination of any possible spelling or grammatical errors one can think of. The strength of the library is at the same time its weakness: since for any useful or even 'right' book, there will be many other books that are useless or books that refute the other books. The library as a whole will not contain any useful information, simply because it contains *any* possible book. In order for a library to be useful, it needs to contain a selection of books, and a catalogue. With reference to the catalogue, Borges writes (1941: 116):

> On some shelf in some hexagon (men reasoned) there must exist a book which is the formula and perfect compendium of all the rest: some librarian has gone through it and he is analogous to a god … Many wandered in search of Him.

An interesting idea: what would be the 'perfect compendium' for a universal library? And how to find it? Obviously, there will be books just repeating the line "I am not the perfect compendium", but also books pointing to some other book saying "the book in hexagon 26232, wall number 4, bottom shelf, 5th book on the right, is the perfect compendium", and other books will say that that book is lying. In other words: finding the *bookman*, as he is called in the story, is an ill-defined problem. One may wonder what this says about building a catalogue of the gigantic and unstructured Internet, which is rapidly growing into a universal library.

Much has been written about the *size* of a universal library. Goldbloom Bloch (2008) mathematically analyses the implications of the settings of (the physical aspects of) Borges' library and shows that the number of books is 25x25x…x25 (and that 1312000 times), which is a 1 followed by 1834097 zeros. This number of books would exceed, by far, the physical space of the universe and the number itself would not even fit in one of Borges' books. In addition, the number of different *orderings* of those books is even more astronomical. These staggering numbers point to one thing: a universal library is a conceptual idea, and for each practical library, physical or digital, only a selection of books can be kept, managed and ordered: it calls for a smart librarian to order a universal library.

Using the same principles, other libraries can be thought of, and have been described

elsewhere, for example consisting of all videos of a particular length, or one with all possible biological blueprints in the form of DNA (Dennet, 2013). Many novel (Internet-based) *electronic* libraries have appeared, such as *Google Books* and *Wikipedia*.[3] The *thought tool* of a universal library is important: in electronic domains, a tiny computer programme could *generate* (instances of) all possible books, by systematical and exhaustive enumeration. Although this would take too much time and space to actually compute, in theory it is possible. Universal libraries transform the question 'what (kind of) book shall I write?' into 'w*hich* book shall I write?'.

A library metaphor for control over information

I have briefly described three mechanisms through which algorithms can take control over our information: *measurement*, *prediction* and *manipulation*. To better understand what digital algorithms do, I invoke an *analog library metaphor,* which materialises these notions. Let us materialise any digital information system as a library and the algorithms controlling it as the librarian. A user utilising the system to obtain information would then be materialised as a library member looking for a specific book, or information (contained in several books) on a particular topic. *Measurement* in this analog setting can be seen as looking at which books the user is viewing, in which order the user browses the shelves, in which order she wanders through the library building, and which information requests she poses to the librarian. *Prediction* algorithms subsequently take such measurements from many users in order to induce detailed *library member profiles*. For example, they can predict that, if someone walks through this corridor, it is *likely* that he or she is looking for books on architecture, and that, if a member browses through books X and Y, it is *likely* that book Z will be considered next. *Manipulation* algorithms then have complete freedom to change, in essence, *anything* in the library: the selection of books, the order of the library and the physical structure of the library itself. Furthermore, they can do this in the blink of an eye, in real-time, based on prediction models. They can, for example, put the 'best' books near the entrance, cluster appropriate books according to the member's current quest, or even close down or downgrade 'undesirable' collections altogether. Considering the web as a library, and a search engine as a librarian, we can now see that the first ten search results are 'close to the entrance', that this selection and order is based on a profile and past search results, and that one might pick any link to read and proceed the journey through the digital library, while the vigilant search engine watches closely.

The physical-universal continuum and libraryness

Physical and universal libraries form two ends of a continuum, ranging from purely physical to total (universal) libraries without any physical constraints. Digital libraries lie on this continuum, increasingly closer to universal libraries in terms of their size and content, but still influenced by some physical constraints such as server space and computational time. Perhaps the closest example, when it comes to a digital library in the traditional sense, is *Google Books*, started in 2004 with the aim to scan, digitise, categorise and make publicly available (physical) books from the world's finest (university) libraries. As Darnton writes (2009: 44):

> so many millions that soon it will have constructed a digital mega-library greater than anything ever imagined, except in the fiction of Jorge Luis Borges.

Physical libraries have physical solutions for storage and ordering, but the activities of a user too have physical aspects, such as searching for a book, walking through the building and manually manipulating the books. When moving from the physical to the universal, we see that both the library becomes less physical and algorithms become more important. More specifically, when we move from analog to digital libraries, we observe the following trends. As far as storage is concerned, physical places become less important, duplicates are no problem and book content can be generated on the fly at any location (e.g., on the Internet). Without rooms, shelves and corridors, the relatedness between books that influences physical positions in the library is replaced by flexible *hyperlink*-like structures that can link books in many ways. In turn, the librarian's activities of selection and ordering are easier since storage and handling costs are minimal. The order of the books can (dynamically) take many forms once physical constraints are gone. Finally, the user's activities in physical libraries include walking routes for browsing, searching and locating. Once freed from physical constraints, any book can be accessed instantly, now completely determined by the logical order.

The reason why thinking of libraries helps in understanding algorithms is largely due to something Edwards calls "libraryness":

> To most people, the word 'library' evokes a mental picture of a particular type of building. The picture is both an external image and an internal one. The form of the library upon which personal and public perception is based draws upon four interconnecting mental constructs. There is the geometry of space, the grasp of mass and surface, and the effects of light colour and other optical phenomena and, most importantly, the presence of people (paraphrases from Markus, 1993: 11). These together, plus the overriding presence of books, allow function (or what librarians call 'operational requirements') to generate distinctive plans and arrangement. It is the four acting together which carry connotations of 'meaning'. Such meaning is expressed in the architecture of the building, the meeting of function and the celebration of the civic realm.
>
> *(Edwards, 2009: 246–247)*

Furthermore:

> To a typical library user, the building has a recognizable plan and image which are rich in cultural meaning. Those who design libraries have a responsibility to convey 'libraryness' through the manipulation of form, space and light.

> … The library is, therefore, a type of building whose image is already well established in the collective mind of society. The mental picture of 'libraryness' is in this sense a sign – a particular type of shape and volume which signals a particular function. Society reads the built sign and receives the meaning codes.
>
> *(Edwards, 2009: 246–247)*

Edwards' concept of 'libraryness' is something that informs the metaphor as I develop it here. Algorithms live in digital space, but by seeing the libraryness of digital information sources, relevant images from our collective mind are immediately present to aid in interpreting such informational contexts.

The days of shelves are over: the *Learning Jungle*

Some way along our continuum, we find *the Learning Jungle*, a (conceptual) project by the architects Rients Dijkstra and Jason Hilgefort (2010). Part of *the library of the future*, it frees books from their shelves and frees them from any formal order by equipping them with radio frequency identification (RFID) chips, to track their location in space. Instead of having a spatial categorisation and fixed, physical places for the books, the books can now be positioned anywhere in the space of the library, and found through radio waves by any 'reading device' (e.g., a smartphone). Interestingly, the *Learning Jungle* somehow keeps the library physical, i.e., it maintains maximal libraryness, but moves the order more towards a digital one where physical location is less important. People can just move books around as they feel, and place books where they think they fit best. In addition, features can be measured, to modify the order further, e.g., covering book use, social influences (like the placing behaviour of many people in the same library space) and context (such as season).

As the *Learning Jungle* architects, Dijkstra and Hilgefort propose (2010: 69):

> This concept also allows for the idea of a "least-in-demand" cellar: the library can move the most popular books to the most frequented spaces, while shifting the books that are less in demand to more secluded rooms. … Another possibility is that the library can adapt itself to reflect the various media used during the different seasons, for example: summer reading versus winter reading.

In line with our continuum, Dijkstra and Hilgefort (2010) discuss the transition from the traditional library to modern, technological ones, and identify dimensions such as "from physical to digital", "from static to dynamic", from "pre-organized to self-organized" and "from fixed to flexible".

Traversing a library: influencing factors

In the *Learning Jungle,* the order in the library is determined by the *combined influences of many other people acting in the same* library. As I have explained before, when moving to digital libraries, algorithms assume the role of librarians and determine this same order. Libraries of information are dynamic because of many influences. Related settings in the physical world include route planners that will plan your travel by car, or the organisation of a supermarket. Both types of organisation of information or goods will vary over time because of external influences (new roads and new products), but also the behaviour of groups of other people (i.e. other visitors of the same library). For example, if traffic is high in some part of the country, routes may be modified to cope with that, and if some type of product in a supermarket is very popular, the structure of the supermarket may change to put that product in a more prominent place. The point is that the structure of any type of information library may change in real-time, instantaneously, and due to many factors that are in or beyond the user's control. In general, there is no *right* order, and certainly there very many *possible* orders. Order arises dynamically, sometimes specifically for each individual user, based on many possible features; not by pre-defined classification schemes.

Figure 2.4 Based on analysis of the user's past library behaviour by the librarian and the data miners, the books (e.g., the first 10 results of a search query) are selected and ordered

I will illustrate three types of information that influence the library order; *personal data*, *social data*, and *world knowledge*. All can be seen as a particular *context* that determines the library's structure. The following images evoke our sense of libraryness by translating back to a physical library.

People make algorithms, and thus people influence our digital libraries. However, individually people do a lot more. Based on huge amounts of personal information, on social networks, by browsing webpages, by using mobile phones, and so on, algorithms can generate *prediction functions* that may be utilised for manipulation, as previously discussed. Google, for example, brings together its user data from *GMail*, *Google Search*, *YouTube*, etc., to form detailed *profiles* of users. We call usage of such information

customisation, or *personalisation.* In terms of the library, what can happen is that the library is structured to bring 'desired' items closer to the user. For example, Amazon and other booksellers may give you a list of recommendations based on a similarity of purchased items with other ones, or in association with the preferences of other correlated users. Another aspect may be that a company predicts personal traits (for example, through *Facebook* data) to limit the number of possibilities. Generally, particular use of a digital library is a strong form of *feedback*: the simple fact that a user traversed a certain link, or not, is already information that can be used to influence the library order. Some software also limits the number of options, e.g., frequently used menu items, based on past use. In addition, a user can often customise a portal or search engine with his interests, demographic information or importance ratios of topics.

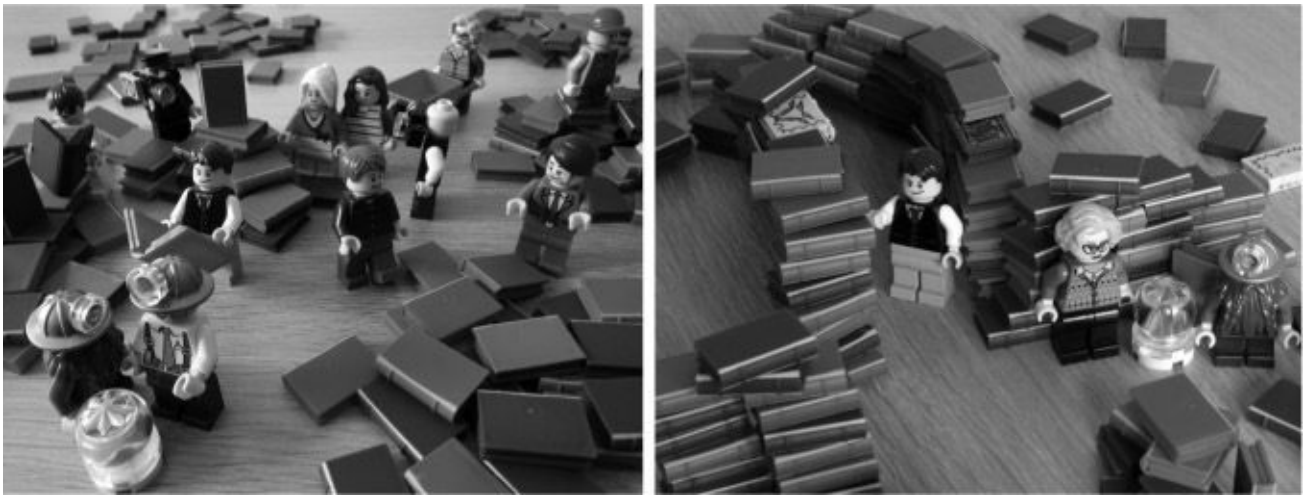

Figure 2.5 The behaviour in the library of many other people (left) indirectly changes the grouping and ordering of books for the individual on the right

In addition to personal influence, how one's information appears is influenced by social aspects. The fact that many people use the same library brings changes to the library beyond the control of an individual. Thus, in the *Learning Jungle*; the very structure of the library was determined by the combination of all other people's actions, moving around books, borrowing books, and so on. In digital libraries, we can observe the same thing. Web search engines work, for the most part, based on how people use it. If more people visit a website, or more people link to a website, it becomes more popular, and the search engine places it earlier in the library order, and this will generate even more visitors. In digital libraries this means that the structure will reflect this *collective* behaviour over time. This phenomenon is also related to Internet selling websites that send you advice on "people who bought X also bought Y". In this second setting, searching for a *particular* book may still be relatively simple, but searching for a particular *topic* may have varying results over time because of other people's interest and behaviour.

A third aspect influencing digital libraries may be the arrangement of general knowledge. For example, search engines become increasingly better at adjusting search results towards *context*, which may be task context, time, spatial location, and so on. If I

search for '*jaguar*' while physically located in the jungle of some country, I might be looking for the Wiki page on the animal, whereas if I am in the center of a big UK city, I might be more interested in the car brand. Search results may use such information in more and better ways to adjust our digital libraries online.

Of course, other influences exist. *Indirect* influences are maybe even more present in the model building phase of (machine learning) algorithms, in the form of (algorithmic) biases mentioned before. Other things now make sense in the library metaphor. For example, the well-known *filter-bubble* concept described by Pariser (2011) (or *narrowcasting,* as Vaidhyanathan (2011: 83) calls it)) may be seen as a library, where only a small subset of rooms is accessible and all point to each other: this way one stays within the confinement of only a few rooms, just because the librarian notices that you seem to enjoy it.

Figure 2.6 The left shows knowledge-based grouping of books according to topics. Once the new user on the right is profiled as a 'dog person', the librarian uses the library itself to infer a good selection of books

Gatekeepers and sharing

In the library metaphor, we can take the "gatekeeper" concept (Granka, 2010) quite literally. Search engines are the gatekeepers of all knowledge that lies within their libraries: they determine where you enter, and which rooms you get to see. The consequences for *access* to knowledge can be significant. Mager (2012) and Bozdag (2013) describe the many forms of *bias* in search engines. Mager explicitly sees dominant capitalist values becoming embedded in the search results. A major problem with search engines is that it is unclear how search results are produced and why. The original *PageRank*[4] algorithm of Google was never fully disclosed, and with the recently activated *Hummingbird*[5] algorithm (which is combination of algorithms), it is even more unclear how the ranking calculation is arrived at. Even if search algorithms were to report all of the decisions and information that determined the search results, it would exceed the capacity for human reading and comprehension, since it depends on vast processes of information gathering, statistical analysis, learning, sampling and filtering. In addition, all influencing factors (such as statistical information about other people, and personalised filters and information) play increasing roles in the search results. Bozdag (2013) shows how different the results are for the same query *"Ajax"* with three different users, producing results on either a programming language, a mythological figure or a soccer club. Each user received their own library order, without knowing how the order was arrived at.

Reading is a cumulative activity, so it is no surprise that how you see your library changes with every book. However, in the digital world, your library is modified by the algorithms of search engines, other people and many other things. Social reading centers around the idea that one *shares* what (and when and how) one reads, with other people. Winget (2013) describes four categories: talking to a friend about a book; discussing a book online; formal book clubs; and engaging in discussions in the margin. Many practical systems now support social reading. Sites like *GoodReads*, and *Amazon's Kindle* hardware platform allow users to indirectly 'communicate' by making notes in books which can get shared. *Kindle* features *popular highlights*, passages in a text that were highlighted by at least two people. Other platforms support *dynamic* books, in which the user can "choose their own adventure" (rendering this a specific universal library of all variants of a particular book). Social reading leaves *electronic earmarks* that influence other people's books, and libraries.

Social reading nudges people into migrating all their reading efforts to the digital domain, where, as I have discussed, powerful librarians can measure, predict and manipulate. For example, when buying at Amazon, you give away what you buy, but, with e-reading on the *Kindle* (on IOS), there seems not to be any way to *read* without being tracked and measured. As Alter suggests (2012): "Your e-book is reading you". Real librarians, in principle, treat your reading habits as confidential – in fact, not too long ago,

reading records were considered confidential – but in digital libraries such privacy is lost. Richards (2012) points to the perils of social reading and the hazards for *intellectual privacy*: the idea that for some ideas people need to know that they are *not* being watched. If all your steps in a digital library are known and even broadcasted through a social network, this may change people's behaviour to socially accepted norms.

The influence of both gatekeeping and sharing mechanisms materialises into how we (are allowed to) move through our metaphorical libraries, and what we see there.

Some reflections on the librarian

The library metaphor helps us to understand what algorithms do by aggregating all that is algorithmic into the librarian. However, we can do more. An analogy can be made with robots, which are similarly formed by aggregations of algorithms. Some algorithms may interpret visual information, some compute joint positions in the robot arms, and some reason about the plan to navigate to the kitchen. However, the best way to understand *the robot* is by using the *intentional stance* (see Dennet, 2013): as a *rational* being, capable of having *beliefs*, *desires* and *intentions*. The field of human-robot interaction (Jones and Schmidlin, 2011) investigates settings in which humans and robots work together. In such cases, the human has to be able to make predictions, such as that the robot *believes* that there are two objects on the table, and it may have the *intention* to *pick up* the left object. Returning to our librarian, we can say that search engines increasingly try to anticipate *our* intentions. According to Vanderbilt (2013), in the future of search: "Google is moving from simple data-retrieval to a system that understands how we think and what we want – before we even know we want it". This is a crucial point: in order to understand the array of Google algorithms, we need to take into account that it has beliefs *about us,* just like in human-robot situations. In addition, it has beliefs about our intentions and desires, and it has desires of its own, e.g., making profit. For example, it makes sense to say: '*I get these search results because the search engine knows I want to visit Barcelona, it is four o'clock in the morning, and I have a tendency to buy things in these early hours'*. The key point is that we can assume search engines have *regular, intuitive* capabilities to reason about, and predict, mental aspects of *us*. We do not have to understand machine learning algorithms in order to understand or predict how search engines work. In other words, we can understand the librarian in any digital library by focusing on its beliefs and other mental attributes. Space restrictions prohibit me from pursuing this direction further, but the idea is to side-step the mathematical algorithmics of machine learning and directly go to a higher level of the ordering of beliefs, desires and *intentional librarians*; a level with which we are accustomed.

Figure 2.7 The librarian, as envisioned by H.G. Wells, who would answer questions from outside users and would select the appropriate texts

Another point I want to take slightly further is the notion of *artificially intelligent* librarians. A search engine is used to receiving a few words, and one would give back a list of pointers to individual webpages. The library metaphor exemplifies that which links we obtain, and in which order, are influenced by a plurality of factors. But at least we obtain the links, which resemble the underlying *sources* of information. Increasingly, search engines try to provide *answers*[6] for queries, without delivering the supporting sources. While I may accept this for "the height of the Eiffel tower", I would have small reservations for "a good pizza in the neighborhood", and I would definitely not want to have a search engine answering the question "who is right: the Israeli or the Palestinians"! A long time ago, Vannevar Bush coined[7] the "Memex", and H.G. Wells wrote about the "world brain", which were similar to Otlet's ideas about gathering all world knowledge (Wright, 2014), ideas of a system, where information could be held on microfilm or punch cards, and where scholars could communicate from their desk via telephone with the library, after which they would get the required information almost instantly. Now that we have such a system in our pockets, and call it '*smartphone*', we should avoid the situation, where the librarian does not let us in the library, but answers all our questions at the door. This prospect becomes more real every day, based on the prediction and manipulation capabilities described in this chapter, but also due to the increasing use of *knowledge* by digital librarians. Thus, as Vanderbilt (2013) explains:

> These are the pillars of Google's future of search: the vast knowledge of user behaviour and intent it already has and it compiling every second; the Knowledge Graph, in which strings become things; and Google's advances in artificial intelligence.

To improve search, you need information; this means that, in order to search in the digital

library, the librarian utilises information from that very library. According to Mickiewicz (2011: 127): "what search engine companies like Google need to even hope to come up with a new semantic search engine, is a vast collection of books". Semantics is the new keyword. Indeed, for Vanderbilt (2013):

> The work on the semantic graph is to make connections that traditional search might overlook. With the Knowledge Graph, Google has taken a different step towards the future of search: providing answers, not links. This raises the question of authority, long on the mind of Google engineers.

Overall, we can say that digital librarians are getting increasingly smarter and more complex, and this will have many unforeseen implications, but, hopefully, by taking the intentional stance, we may be able to study and understand them better.

Conclusion

This chapter has introduced a library metaphor to understand the role and power of algorithms in the ordering and visibility of digital information. It has utilised pre-existing knowledge about libraryness in order to offer a novel understanding of algorithms. The study and understanding of new digital situations, ranging from internet shopping and the news industry to massive open online courses (MOOC), can benefit from this approach.

One significant implication for privacy and surveillance is that *Big Brother* has become *Big Librarian*: the biggest threats do not come from oppressive forces of surveillance, but from algorithms acting as friendly librarians who *nudge* and *manipulate*. Among many political questions, one relevant question is simply this: who hired them and who authorised their judgements? Privately owned digital librarians tacitly act as gatekeepers for various kinds of information based on their own business models, without the public knowing how and why, and without much public debate on (the desirability and morality of) their role. A related legal question presents itself: who is legally accountable for the behaviour of digital librarians? This issue is made even more pressing with algorithms becoming increasingly more *adaptive* and *autonomous*.

Another significant implication concerns the socio-epistemological aspect, when we move from 'big data' to *Big Knowledge.* Algorithms that use extensive knowledge and pretend to deliver perfect answers to our questions should be approached with absolute skepticism. After all, as I have described, perfect compendia (for universal libraries) are merely fictional ideas, and, for every practical library, however large they may be in terms of terabytes or petabytes, considerable bias is at play. Society-wide consequences of *outsourcing* increasing numbers of knowledge-intensive activities to digital librarians are still unknown, but given the potential to shape our social capital of knowledge, we should start to consider them now.

Notes

1 See '*Metaphors we live by'* (Lakoff and Johnson, 1980).

2 See Wright (2014) and Nerdinger (2011b) for Borges' predecessors writing about similar ideas (e.g., Fechtner, Lasswitz, Carroll and Swift).

3 See http://dp.la and www.europeana.eu for public Google book alternatives.

4 http://computationalculture.net/article/what_is_in_pagerank

5 http://searchengineland.com/google-hummingbird-172816

6 See Goldman (2011: 103) on *portalisation*.

7 For a comprehensive history see a recent book by Wright (2014).

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Part II

Calculation in the age of big data

3

Experiencing a Personalised Augmented Reality

Users of *Foursquare* in urban space

Sarah Widmer

Introduction

Several scholars have recently reported on the emergence of a geoweb (Crampton, 2009; Leszczynski and Wilson, 2013; Graham, Zook, and Boulton, 2013) or the explosion of new 'spatial media' on the web (Crampton, 2009: 91) to describe the abundance of content associated with places which is currently available online. The mass distribution of smartphones and the rise of mobile Internet have made access to this content almost ubiquitous, allowing us to 'augment' our experiences of places with an additional layer of digital information (Graham, Zook, and Boulton, 2013). Finding a café near to where we are, checking availability at a restaurant to book a table, making sure we took the right road to get to our next appointment: these small everyday problems are increasingly resolved using a smartphone and a variety of software running on this interface and providing geographic information.

These 'apps' often filter their content based on our location (the so-called 'location-aware apps' or 'location-based services'). Increasingly, they also filter information according to the user's profile. This personalisation of geographical information is not an isolated phenomenon, but part of a larger trend towards the personalisation of web content. As proposed by Pariser (2011), the algorithms used to provide us with targeted advertising when we browse the Internet, today also define the informational content of many of the sites we visit regularly. Facebook newsfeeds, Google search results, Netflix or Amazon recommendations: these online services analyse a series of signals about the behaviour of their users (e.g., links they click, their search or purchase history, the content of their emails) to infer the type of information that they may want to access next.

Online services providing geographical information are not left out of this trend. The director of *Google Maps* for mobile, Daniel Graf, has recently announced the personalisation of Google's cartographic service, justifying this shift by stating that the maps he consults do not necessarily have to be the same as those consulted by the journalist interviewing him, as they are unlikely to frequent the same places (Lardinois, 2013). Whether we are using *Google Maps* for directions, *Foursquare* for recommendations, or getting information from *Mynd* or *Google Now*, several geoweb services differentiate their content depending on what their algorithms understand about what we want.

In order to personalise their content, these applications must have an idea of 'who'we are. To do this, they analyse a number of pieces of data pertaining to us. Which links we click, the people who make up our circle of friends on Facebook, the content of our calendar, the addresses we have previously looked up on *Google Maps*: these "capta" – "units that have been selected and harvested from the sum of all potential data" (Kitchin and Dodge, 2011: 5) – are used as a type of indicator of who we are and what we like. Taken together, these digital traces that we leave behind form what Kitchin and Dodge call a "capta shadow", a kind of digital shadow of ourselves, which, rather than just following

us, also precedes us, defining the choices and opportunities that are available to us (Stalder, cited by Kitchin and Dodge, 2011: 104). These profiling techniques could, therefore, be considered to be predictive technologies, working on the assumption that knowledge about the future is already present in the analysed data (Amoore and de Goede, 2008: 174).

This personalisation of geoweb services, therefore, defines different "regimes of visibility or invisibility" (Graham, Zook, and Boulton, 2013: 470) of geographical information. Thus, by differentiating their content, these services create different accesses to the information that users rely upon to resolve some of their navigational problems within urban space.

In this chapter, I examine the issue of geoweb personalisation by studying uses of the smartphone app *Foursquare* in New York City. This application allows receiving targeted recommendations about places to visit nearby (cafés, restaurants, bars, etc.). Through the discourse of users of this application, I seek to understand how receiving personalised content mediates the relationship that these users have with their urban environment. The discussion proceeds in four stages. The first section aims to situate geoweb personalisation within the context of its emergence and also within the scholarship on concerns regarding profiling and the personalisation of web content. The second section presents the privileged theoretical perspective and concept for approaching the object of the study (the concept of "mediator" as discussed by Bruno Latour (2005)). The third section puts forward the case study (*Foursquare*) and outlines the methodology. The last part – the analysis – is divided into two main subsections. First, it seeks to understand what specific mediators shape the augmented spatialities enacted by *Foursquare* users. Second, the analysis focuses on how users of *Foursquare* experience the differentiated "informational landscapes" hence emerging (Crang and Graham, 2007).

Situating the personalisation of geographical information

Context of emergence

In his work on new media, Manovich (2001: 41) states that:

> If the logic of old media corresponded to the logic of industrial mass society, the logic of new media fits the logic of post-industrial society, which values individuality over conformity.

The personalisation of web content could thus be read as a trend that epitomises our contemporary society and the dynamics of individualisation that have spanned the past few decades. Today, a person's life course is increasingly destandardised, becoming more and more the result of choice and personal development (Beck, 2001), giving rise to a "significant transformation in the economy of individuality" (Castel, 2010: 125, my translation). It is within this context that we must situate the development of the technological tools that increasingly seek to target individual needs.

However, the personalisation of consumer goods and services must also be read as a manifestation of the "political economies of 'unbundling'" (Graham, 2005: 564) that characterise the current neoliberal logics of governance. The decline of the Keynesian modern state and the shift to neoliberal regimes are accompanied by the phasing out of the idea that major infrastructure services (telecommunications, rail, roads, etc.) are 'public' services that should be available to all at standard tariffs (Graham and Marvin, 2001: 96). We are moving, therefore, from a universalist model of services for the population to a model in which the basic infrastructures, spaces and services of everyday become commodities that can be differentiated and adapted to the profile of the consumer (Graham, 2005: 565–66).

‘Software-sorted geographies’ and ‘filter-bubbles’

Within this general context, consumer goods and services become ever more customisable commodities. Consumers are increasingly involved in the production of what they buy, becoming “prosumers”, able to customise the goods they acquire by choosing options, materials or colours (Kitchin and Dodge, 2011: 187). Digital geographical information has also become a service that users can customise according to their desires at the time. Thus, de Souza e Silva and Frith (2012) show how some location-aware smartphone applications allow their users to ‘browse’ the space around them to locate the type of place they are looking for.

Beyond this direct personalisation by the user, here I focus on the ‘automatic’ personalisation performed by computer algorithms by analysing the digital traces that individuals leave behind in the course of their various operations online. According to Graham (2005), computer code plays a vital role in the neoliberal logics of service differentiation. Software has the ability to distinguish various types of situations based on the data that it captures and analyses, thus creating differentiated geographies according to those specific situations. These “software sorting” operations are problematic because they often define different rights, accessibilities and speeds; they may well be the basis of new forms of social sorting, dividing individuals and social groups “into categories, assigning worth or risk, in ways that have real effects on their life-chances” (Lyon, 2005: 1) and channel their choices and opportunities.

The personalisation of web content can be read as a software sorting operation defining differentiated access to online information. Although these different regimes of visibility or invisibility of information do not necessarily give rise to the abovementioned discrimination, they can nevertheless pose a series of problems that should be addressed. According to Pariser (2011), by rendering visible only that which corresponds to our tastes, our interests or our political views, these systems lock us into “filter bubbles”, where we are constantly served

> a kind of invisible autopropaganda, indoctrinating us with our own ideas … and leaving us oblivious to the dangers lurking in the dark territory of the unknown.
>
> *(Pariser, 2011: 15)*

By hiding anything we might find unpleasant, disturbing or just different from our views, this filtering process is, in Pariser’s opinion, a threat to the exchange of ideas that characterises democratic debate. Pariser (2011) denounces these systems not just for the way in which they shrink the world to what is familiar, but also for their opacity, which prevents us from understanding why we are accessing the content provided, and from assessing whether the algorithms were able to ‘understand’ us correctly.

When these filtering processes are applied to the geographic information that we use to make sense of the world around us, the contents that we receive represent only part of the

city: that which is supposed to please us and correspond to us. The consequences of these various visibility and invisibility regimes are problematic for at least two reasons. First, these software sorting operations can potentially reinforce homophily patterns: "the principle that a contact between similar people occurs at a higher rate than among dissimilar people" (McPherson, Smith-Lovin and Cook, 2001: 416). Thus, reinforcing specific forms of togetherness, accentuating pre-existing socio-spatial fragmentations. Second, unlike the customisation evoked by de Souza e Silva and Frith (2012), the users of this software do not choose the filter which is used to interpret the world. Although users obviously maintain a degree of flexibility with regard to the information they receive (they decide whether to rely on it or not), they cannot really judge the accuracy with which they have been profiled. Thus, the opacity with which software functions "raises huge issues in agency terms" (Klauser and Albrechtslund, 2014: 276).

In what follows, I outline the conceptual framework and examine the underpinnings of the experiences of *Foursquare's* personalised "augmented realities", this latter term being defined as "the material/virtual nexus mediated through technology, information and code, and enacted in specific and individualised space/time configurations" (Graham, Zook and Boulton, 2013: 465).

Mediators

Broadly speaking, this chapter seeks to understand the role played by 'things' (smartphones, apps, information filtered through algorithms) in the relationship that users have with space. For this purpose, I employ the concept of the "mediator" in the way used by Bruno Latour and Actor Network Theory (ANT). One of the aims of Latour's "sociology of associations" is to slowly disentangle the node, knot and conglomerate of the many surprising sets of agencies (Latour, 2005: 44) that are involved in the course of action. The concept of mediator has to be understood in this context. For Latour, a mediator is not a mere intermediary conveying "meaning or force without transformation" (2005: 39). It is, instead, an agent of translation, which transforms the meaning of what it is supposed to transport (39). In this vision, the mediators are agents involved in an action, only a small number of which are human (50). Since an actor is "what is made to act by many others" (46), the mediator is an agent that makes other agents or mediators do unexpected things. In this perspective, "ANT pictures a world made of concatenations of mediators, where each point can be said to fully act" (Latour, 2005: 59). Resolving a navigational problem using a smartphone application involves different agencies: the agency of the user, of course, but also the agency of software and the "concatenations of mediators" that underpin it:

> Capta standards, file formats, interfaces, conventional statutes, protocols, intellectual property regimes such as copyrights, trademarks, patents … ways of doing, coding cultures, hacker ethos, norms of sharing and stealing code.
>
> *(Kitchin and Dodge, 2011: 24)*

The 'things' on which this chapter focuses must therefore be seen through this perspective. In much the same way as "an association with God is not substitutable by any other association" (Latour, 2005: 36). An association with a smartphone application, whose content is personalised through numerous computations, cannot be likened to an association with another navigational instrument. It is, therefore, necessary to understand how the various mediators, involved in the association between the user and an app, such as *Foursquare*, act. To understand what augmented realities emerge from the association of these various agencies, the analysis is divided into two main parts: the first seeks to understand what the main mediators that underpin *Foursquare's* functioning and contribute to make the user act are; and the second part focuses on users' experiences of these augmented realities.

Foursquare

The personalisation of geospatial information is investigated here by way of a case study into the uses of the smartphone app *Foursquare* and its recommendation engine. *Foursquare* is a location-based social network, created in New York City (NYC) and

launched in 2009. Until recently, *Foursquare* allowed its users to post 'check-ins' in various locations (bars, cafés, restaurants, museums, public spaces, etc.), informing their social network of their whereabouts. In addition to check-ins, users could also rate these locations by posting a comment accessible to other members of the network. The content of the application is, thus, largely user-generated.

To encourage its users to post 'check-ins', *Foursquare* was, in its infancy, presented as a game, awarding points and badges to users when they 'checked into' places. Over the years, the company has accumulated millions of 'check-ins' from its users. With this huge amount of data on users' spatial practices and habits, *Foursquare* has gradually started to profile itself as a local search engine providing personalised information about nearby venues. The first step in this direction, in 2011, led to the creation of a recommendation engine indicating bars, restaurants and cafés near to the user. In August 2014, a new step was taken by the company with the launch of an entirely rewritten *Foursquare* app, focusing solely on local search and personalised recommendations (the social and fun aspects associated with 'check-ins' being transferred to a new application called 'Swarm'). This chapter focuses on *Foursquare's* recommendation engine before the recent revision of the app, the one that operated in the following way. When the user received a list of recommended places, the information provided was filtered based on her location, and also according to the time at which the search was performed (for example, cafés and bakeries were more likely to be recommended in the morning than in the evening). *Foursquare* also personalised its recommendations by analysing users' check-in history and that of their friends. Thus, if users searched for a bar in a neighbourhood that they did not know, *Foursquare* would primarily recommend bars where their friends had previously checked in. At the time of my fieldwork, the service was also personalised through collaborative filtering methods, comparing the profiles of users who had checked into the same places and then recommending places to user A on the basis of the places frequented by users B, C and D, whose check-in habits were similar to A's.

Foursquare recommendations, therefore, relied on the system's capacity to analyse the vast database of users' 'check-ins' (in 2014, these had reached six billion, according to the company's website). From check-in data, the system computed the similarity between venues and between users, and highlighted contents that were tailored to the user's profile. In this version of the app, for each of the recommendations shown to the user, *Foursquare* specified why the recommendation had been made. The recommended location was thus accompanied by a short explanation, such as: "three of your friends have been here"; "people go there after Café X"; "people who like Café Y go here"; and so on. The personalisation performed by the software was, therefore, not completely opaque to the user. In its new version, *Foursquare* focuses more than ever on personalisation and – in many respects – it continues to be based on users'past 'check-ins'. But first and foremost, the emphasis is now on the reviews written by users.

The data analysed in this chapter was gathered during the field work in NYC in 2013 and

2014, when thirty semi-structured interviews were conducted with users of smartphone applications and, in particular, *Foursquare*. The majority of my respondents were using the app in order to receive recommendations about places to go in their area. The semi-structured interviews allowed me to appreciate the way my interviewees perceived the fact that they were receiving such highly tailored information; and how they interpreted and used this information to make decisions about where to go. This method presented a limitation, however, arising from the fact that some of the respondents were not aware that the results they obtained were personalised. This lack of knowledge about the profiling performed by the application is in itself an interesting result, showing how computer code influences our daily life, sometimes without us even noticing it. Although these people were brought in to express their opinions on the personalisation of information, they had not developed conscious uses of these tailored recommendations and, therefore, were less able to discuss the ways in which this profiling mediated their practices. As the discussion developed better with interviewees aware of the personalisation at the time of the interview, I am drawing mostly on these interviews.

What mediates users' augmented realities?

In their paper, Graham, Zook and Boulton (2013) mention different types of power involved in the shaping of augmented realities. Those different types of power result from the activity of social actors, and from the actions performed by software and code (2013: 468). In what follows, I refer to these two broad categories of mediators that shape the informational landscapes of *Foursquare*.

The first mediator: the activity of other users and the content they produce

When reporting their experiences of the app, several interviewees explained that *Foursquare* had allowed them to discover an exceptional restaurant or café in an area of NYC, or in another city, that they didn't know well. Mark, for example, mentioned that it would have been difficult to see the restaurant he was looking for from the street, if the application had not revealed its whereabouts:

> The [restaurant] that Ellen and I were going to was like … you have to go down this alley … it's behind this building and you can't see it from the street. I would have never seen it otherwise.
>
> *(Mark, interview, 5 September 2013)*

The application makes visible those places that the materiality of the city would otherwise keep hidden from the eyes of the uninitiated. This feeling of being able to see through walls reflects the "dreams of urban transparency and omniscience" (Crang and Graham, 2007: 812) associated with the emergence of augmented space. These authors point out, however, that this dream of transparency is a myth, since those technological systems always produce new shadows and opacities (207: 814). Graham and Zook (2011: 129) make a similar argument when they write: "the cloud of virtual information superimposed over place is thick and dense over some parts of the world, and little more than a wisp over others". For a city the size of New York, the layers of digital information provided by *Foursquare* are far from uniform. As the content is largely generated by users, the density of available information can vary from one area of the city to another, depending on how often it is frequented by users. One of our actors gave her opinion about the limited information thus available on the bars and restaurants in her neighbourhood, explaining:

> [My neighbourhood] is pretty far, pretty remote. And not a lot of the people that are out there use *Foursquare*. So sometimes, a restaurant … even if it's popular … it will have like three tips and ten check-ins … It is a Mexican neighbourhood … So I think that's part of it.
>
> *(Ellen, interview, 13 August 2013)*

Ellen's interpretation is consistent with the "distributed power" argument proposed by Graham, Zook and Boulton (2013). According to these authors, only a relatively small group of people is involved in "authoring representations in augmented reality", which

gives these people “a corresponding high power to influence representation of places” (2013: 469). The profile of *Foursquare* users, and the neighbourhoods these people principally frequent, contribute to the creation of different densities of content for the various parts of the city. If the information provided by *Foursquare* makes some things visible, other places or neighbourhoods remain more or less in obscurity due to the low density of content available about them. The availability of content is, therefore, an important mediator shaping the augmented realities enacted by my interviewees.

The second mediator: Foursquare's *personalisation algorithms*

Foursquare's informational landscapes are also shaped by the action of algorithms, orchestrating the visibility or the invisibility of contents. These algorithms filter information based on criteria such as location or time of the day. On *Foursquare*, the ranking of recommended places is also based on the status and activities of other users. In particular, algorithms prioritise two 'alterities' in order to personalise recommendations.

First, *Foursquare's* results are ranked via collaborative filtering methods, which involve cross-referencing check-ins made in the same places. This principle – made famous by the company Amazon.com – consists in recommending to user A those venues frequented by users X, Y and Z, who have checked into similar places than A. Thus, by looking for those patterns between users, the application highlights a relationship with a form of alterity that Neil describes as "people like me":

> This neighbourhood, I've never checked in here before. But … other people have checked in … Finding … using an algorithm to find the places that people like me go to most, nearest me, and then listing those.
>
> *(Neil, interview, 14 August 2013)*

Second, the algorithms highlight the places in which the user's friends on the platform have checked in. Recommendations are therefore accompanied by indications such as "Your friend, X, left a tip here" or "Three of your friends have been here". According to my interviewees, seeing the places frequented by some of their friends represented another way of obtaining information that they could generally trust.

> Once you see there is a shared interest, I feel like … You have the history of what they like, you know what you like and you see a lot of commonalities, everything matching up … If I go to visit somewhere that they have been … I would say "hey, Jim and Maria were here, let's try that!"
>
> *(Mark, interview, 5 September 2013)*

By highlighting those two categories of users (friends and 'people like me'), *Foursquare* prioritises information endorsed by people with whom users potentially have affinities. In doing so, it displays a certain representation of the city and its places: one shaped by a community of users who may well share similar tastes. Although it seems reasonable that someone should be able to find a restaurant or bar that suits his/her aspirations, the social distribution of tastes is not completely left to chance, but reflects different positions within the social space (Bourdieu, 1979). The creation of those 'bubbles' of personalised information might therefore accentuate homogeneous forms of togetherness. To understand the socio-spatial implications of these filtered informational landscapes, it is necessary to further examine how those personalised augmented realities are lived and experienced. In the next section, drawing on the discourses of my interviewees, two problematic aspects of these experiences are addressed.

Living in 'bubbles': users' experiences of personalised augmented realities

Personalised augmented realities and the consumption of places and neighbourhoods

By personalising the content of the application on the basis of his/her tastes, *Foursquare's* algorithms define different regimes of visibility and invisibility of geographical information for each user. While some may dislike the fact that some information is rendered invisible, many see it as a necessary evil. Thus, Neil, while recognising that he might miss something because of the profiling to which he is subjected, thought it was preferable for the information to be filtered. Without filtering, the surplus of available information would likely be counterproductive, preventing him from making a decision about where to go.

> I think I would prefer something that gives me fewer results … more accurate results. I'll be willing to make this sacrifice. It's very possible that I could miss a hidden gem … because [*Foursquare*] knows that I like new American … fancy places … So it picks those. But then [if] there is a really good noodle shop … it's like two dollar noodles nearby and it's not my typical place, but it is still really good … maybe I'll miss that.
>
> *(Neil, interview, 14 August 2013)*

By using *Foursquare*, the interviewees – those who were aware of the personalisation – generally knew through which lenses they approached the world. Thus, the augmented space that they were accessing was not exactly the same as the one they would have accessed via *Yelp*, a local search engine whose rankings are based on other criteria, and which prioritises the most popular and best rated venues.

> So *Yelp* is not filtered as well … I look [at *Yelp*] if I want a wider range of results … In *Foursquare* it's, like, more filtered and usually the results are better but sometimes … if [the places] are too far away … or if [they are] too expensive or not what I am looking for at the moment [I would use *Yelp*].
>
> *(Ellen, interview, 13 August 2013)*

Mindful of how these search engines function, Ellen strategically used one or the other to obtain a more or less filtered representation of what was around her. Adam, meanwhile, deliberately used *Foursquare* to access content tailored to his needs. He paid little attention to *Yelp* or Google results, judging that the places most people defined as popular were not necessarily those where he wanted to go. His use of *Foursquare* allowed him to sustain his distinctive practices and do away with the more mainstream information that it deemed to be of no use to him.

> If you search on Google or something … the first thing that pops [up is] always Starbucks Café … Because they are everywhere and, you know, they are popular. But because I don't go to Starbucks, I go to places … like Gorilla Café … I go to small business cafés … If I go to a new town, [*Foursquare*] is going to find that small coffee shop that is not a Starbucks.
>
> *(Adam, interview, 5 August 2013)*

From Adam's point of view, the fact that an algorithm masks some of the information is

useful, allowing him to exclude from his field of vision places that don't suit his tastes: "Like I said… I don't want a map to show me all the Starbucks. I don't care where they are" (Adam, interview, 5 August 2013). The comments of these interviewees – who are particularly knowledgeable about how *Foursquare* works – seem to indicate that choosing which bar or restaurant to go to is seen as a mere consumption practice that can be personalised to suit each person's lifestyle. Because bars, cafés and restaurants belong to certain neighbourhoods, the spatial practices mediated by *Foursquare* can thus be seen as a manifestation of the "consumption of neighbourhoods" described by Burrows and Ellison (2004) and Graham (2005). This selective consumption of recreational places adds to "the consumption of housing, education and all manner of geographically specific services and attributes" (Graham, 2005: 570–71). From this perspective, the distinctive consumption practices mediated by *Foursquare* can be seen to enable the "strategically inclined" (571) and "technologically literate groups" (572) to free themselves from the common experience of urban space, reinforcing the splintering geographies that characterise our contemporary cities.

Experiencing augmented realities in qualitatively different ways

As previously argued, the relations to space that *Foursquare* enables depend on users' relationships with different types of alterity. To provide personalised content, the app's algorithms filter information based on the activity of two categories of users ('my friends' and 'people like me'), whose tastes may well be similar to those of the user. However, access to personalised content is not only mediated by algorithms, but also by the different densities of content produced by friends and 'people like me'. As expressed by Ellen below, when there is a lack of assessment by people she knows, she must settle for less personalised information. She thus commences a relationship with another type of alterity – "strangers".

> My neighbourhood … is off the beaten path … For instance, if I look up some place to go in my neighbourhood … the recommendations aren't as robust as they are here [in Manhattan]. There are still a lot of places that they suggest but they don't always have … you know … "ten of my friends have gone" to each one … and it's usually "one person has gone here", "one person has left a tip there". But it's not … as data-rich … So you know in that case that you have to go by the tips of strangers … which is not as personalised but it's still useful.
>
> *(Ellen, interview, 13 August 2013)*

It is interesting to see that the augmented space, which Ellen navigates, consists of both 'data-rich' areas (where her friends within the network also spend time) and blank data fields, neighbourhoods for which the information could not be personalised as finely due to a lack of check-ins by friends and peers. While acknowledging the usefulness of "tips of strangers", Ellen's discourse seems to indicate that recommendations endorsed by her friends would be considered as more useful. Because they are mediated by these 'alterities', to which users assign more or less value, *Foursquare's* augmented spaces seem to be experienced in qualitatively different ways.

For Mark – Ellen's boyfriend – all of NYC is experienced as a blank field, or at least as much less 'data-rich' than for his girlfriend. Having just arrived in New York, and not having used the application as assiduously as Ellen, Mark found himself in a quite different augmented space than that of his girlfriend:

> Because I would do the same thing with Ellen … like we both pull out the same thing and she would have a different list because her friends have been to places and recommended things that I … I don't have those friends … She has maybe hundreds of friends on [it] … So there is much more data in there about what her friends like and where they have been. Mine is more limited. So we would both pull out *Foursquare Explore* and she's like "let's try this" and I am like "ah I don't know what that is!" … [So I tell her] "You're going to have a much more data-rich experience so go ahead and … you search and find what people are saying because … for me I have like ten friends".
>
> *(Mark, interview, 5 September 2013)*

Although they are a couple and are likely to share similar tastes in many fields, Ellen and Mark are immersed within different informational landscapes. If Mark is to be believed, the personalisation of the service is in some way reserved for 'premium' users who, like Ellen, have a vast network of friends and a long history of check-ins. To receive personalised information, it is necessary to feed the system with data, to allow it to collect and store these *'capta'*, which allow it to profile its users. As Mark had not yet left enough digital traces behind him, he felt like *Foursquare* did not know him well enough: "They definitely want to personalise it to me … but … they don't know me that well" (Mark, interview, 5 September 2013).

Graham, Zook and Boulton (2013) argue that augmented realities are always unstable, and context-dependent. By showing that augmented space is experienced in qualitatively different ways, my case study also points in this direction. Indeed, access to personalised content is not guaranteed evenly across the territory. When in an area frequented by people with similar tastes to their own, users can more easily access recommendations that are tailored to their needs. Failure to access the same quality of information in neighbourhoods less frequented by their peers could, therefore, highlight a divide between areas with which they could easily become familiar and areas which are unknown, different and more difficult for the user to approach. The example of Mark and Ellen also shows that the differentiation of content based on the user's profile can be experienced as an access to a lower quality augmented space.

Conclusion

The chapter focused on the algorithmic personalisation of geographical information. It aimed to understand what is at stake when the information used to make sense of one's environment is differentiated for each user by various computations. This issue was investigated by way of a case study into the uses of *Foursquare*, a smartphone app providing personalised recommendations about nearby venues. Through the discourses of users interviewed in 2013 and 2014 in NYC, I sought to explore how *Foursquare's* personalised recommendations affect users' relations to their urban environment.

As we have seen, these relations to space are, at the same time, relations to the other users of the platform – referred to by using the term 'alterity'. In other words, users' spatial knowledge is mediated by the densities of contents produced by other users. Drawing on the argument of a "distributed power" shaping augmented realities (Graham, Zook and Boulton, 2013), I have shown that some parts of the city are less visible than others due to the low density of contents produced about them. Furthermore, the visibilities and invisibilities of places are also shaped by *Foursquare's* personalisation algorithms, which prioritise two specific alterities: users' friends on the platform and people whose behaviours are similar to theirs. By highlighting recommendations on places frequented by these two alterities, *Foursquare* enables its users to make informed decisions and go to places approved by people who have tastes similar to their own. It has been argued that, by reducing alterity to these two figures ('my friends' and 'people like me'), *Foursquare* could potentially accentuate homophily patterns and strengthen specific forms of togetherness. The "bubble" metaphor, proposed by Pariser (2011), has proved to be useful in describing those homophilous communities mediated by software sorting operations.

As users' augmented realities are mediated by alterities ('my friends', 'people like me', 'strangers'), to which users assign more or less value, these augmented realities are experienced in qualitatively different ways. Thus, the fact that some neighbourhoods are richer in personalised information than others could accentuate a divide between areas that the user could easily become familiar with and areas that are unknown, different, and therefore more difficult for the user to approach. The quality of augmented realities largely depends on algorithms' aptitude to understand who the users are and what they want. Importantly, the question of *Foursquare's* ability (or inability) to know who they were was frequently addressed by the interviewees. This raises the question of the accuracy with which users are profiled. Is the 'self' that *Foursquare* shapes throughout the analysis of user's check-ins an accurate representation of who she really is? In this regard, one interviewee pointed out that, although his check-ins reflected where he went, they didn't say anything about his experience of these places. He gave the example of a café, which he didn't particularly like, but where he went and checked in almost every day because it was close to his work and, hence, convenient. By pointing out that his check-ins data were not

sufficient to characterise what he felt or thought about the places he frequented, this user showed the fragility of these profiling operations (interview, Charles, 21 April 2014). Nevertheless, it is this '*Foursquare* self', built from scattered and incomplete digital traces, that shapes users' personalised informational landscapes. In the face of the profiling performed by the personalisation algorithms and the figures of the self that they present, it is important to ask ourselves what the risks are that are associated with the possible misinterpretations made by software, and how these errors are then enacted or overcome by the users when they are confronted with personalised content.

The recently launched new version of *Foursquare* seems to be trying to correct this weakness by encouraging its users to write reviews on the places they frequent instead of checking in. The augmented realities shaped by this brand new version of the app – and by the new mediators that are involved in the personalisation of its contents – are yet to be examined and understood.

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4

A Politics of Redeployment

Malleable technologies and the localisation of anticipatory calculation

Nathaniel O'Grady

Introduction

The instituting of new emergency preparedness measures through legislation such as the *Civil Contingencies Act* (2004) brought about major renegotiations in the operation, rationale and organisational shape of emergency response in twenty-first century Britain. As noted across literature, key to these changes was the transformation of emergency response into an armature of anticipatory governance (Anderson, 2010a; Amoore, 2013). Although far from fully encompassing their entire set of responsibilities, Fire and Rescue Services (FRS) and the Police and Ambulance services were charged with preparing and intervening in the present to secure emergencies of the future. This anticipatory turn, as many have indicated (e.g., Anderson, 2010b; Aradau and van Munster, 2011), was initially oriented at managing large scale emergencies whose potentiality came to occupy the post-9/11 security landscape. Known by their possibility in the future, emergencies like terrorism and natural disasters were to be managed at least in part by emergency responders through action in the present.

Becoming anticipatory involved a temporal renegotiation in the modes of intervention used to secure events understood by their catastrophic potential. Anticipation built the capacity to govern large catastrophes in advance of their unfolding. An increasing amount of literature, furthermore, scrutinises how these modes of intervention were developed in conjunction with forms of calculation, which understand, comprehend and capture catastrophes as so many risks.[1] Large scale events were to be known in the same way as they were to be acted upon; by their potential in the future.

A month before the *Civil Contingencies Act*, the *Fire and Rescue Services Act* (FRS Act) was introduced into British Parliament. The *Fire and Rescue Services Act* implemented some very similar changes as the *Civil Contingencies Act*. A reaction to the same set of catastrophic and large scale events, the FRS Act re-problematised the operation of the FRS. It instilled within the FRS a strategic architecture organised around anticipation, consolidated around a three-pronged approach to security consisting of prevention, protection and preparing response. The new strategic architecture not only shaped the FRS' contribution to response at the time of a large scale catastrophe, but renegotiated the service's response to the emergency event they attend to daily: fire. Echoing the *Civil Contingencies Act*, not only was fire to be governed in anticipation of its occurrence, but was also to be known and calculated by its futurity and risk.

Comparison of the two Acts demonstrates that the emergence of risk governance has not only been applied to make sense of, and attend to, large-scale events. The organisational and epistemic transformations, which have produced the contemporary FRS, suggest that practices of risk governance take flight and find new fields of application within more banal types of emergency. As a term encompassing a variety of governing agents, O'Malley (2004) argues that the "security apparatus" is flexible and adaptive to an expanding array of

events which fall under its purview. Recent literature (e.g., Adey and Anderson, 2012; Collier and Lakoff, 2014) has additionally proclaimed that multiple renditions of emergency prevail across this apparatus to make sense of future events. Encompassing a multiplicity of organisations, the security apparatus is thus characterised by processes of appropriation, localisation and redeployment, by which similar techniques will be used to govern an array of different emergencies whose only sure similarity is their apprehension as risks.

But what enables and facilitates the flexibility of the contemporary security apparatus? In this chapter, I show how calculative devices circulate and travel to new contexts. I focus on how, under the flexible dynamic by which one organisation adopts governmental practices already prevailing across a wider apparatus, lies another process of redeployment. The re-deployment that I focus attention on here pertains to the digital risk calculation technologies, which allow risk governance practices to rise to the fore at disparate sites across the security apparatus.

Characterised by, but not limited to, a myriad of digital technologies, algorithmic code and data, the emergence of "information society" (Lash, 2002: 2) has proven crucial to contemporary securitisation, whether adjudged to have opened up entirely new calculative logics (e.g., Amoore, 2013) or to have reworked prevailing forms of calculation (Daston, 1988). New forms of surveillance, monitoring and software are designed and become dis-embedded from specific sites and can be appropriated by heterogeneous sets of users towards a multiplicity of ends. As de Goede (2012) describes, for example, data acquired through credit checking agencies not only create credit histories of consumers, but go on to identify potential terrorists. In this chapter, credit checking data is also shown to be used to identify populations most vulnerable to fire risk. In part, the instantiation of anticipatory forms of governance is thus conditioned and facilitated by the free floating nature of some digital forms like data and software.

Before bringing about new forms of governance, such technologies must undergo processes of localisation, whereby they become re-oriented toward the specific governmental goals of particular security authorities. Throughout the chapter, by localisation I mean processes by which universally available digital agents, like data and software, are appropriated by, and transformed to adapt to, new organisational contexts and spaces. Specifically, I outline and critically discuss processes by which software and data acquired by the FRS are transformed to construct, and to ultimately manage, fire as a risk. I examine two processes that condition the localisation of risk analysis technologies and their redeployment in the FRS; data sourcing and the practice of new forms of risk calculation. I demonstrate that these processes of technological redeployment are vital to the broader adoption of anticipatory governance practices in the FRS and the re-application of such practices to the quotidian event of fire.

The capacity of organisations within the security apparatus to take upon new modes of operation is indebted to the flexibility and malleability of digital technologies. When

describing databases vital to counter-terrorism security, de Goede (2012) argues that the flexibility of software instigates questions about where the authority to govern lies across and between domains of public security and the private space of software developers. Do universally available technologies merely aid the development of new modes of governance for established agents of security or does the authority to govern begin to spread across a wider set of organisations, including private data collection companies and software designers? I address this question in the conclusion, suggesting that rather than a shift from public to private domains of authority, the public intersects with the private in new ways.

Fixing data circulation in the form and matter of data mobility

To enable and engender a new risk-based, anticipatory approach to the governance of fire, over the last decade a digital infrastructure has gradually formed in the FRS. The primary task of this digital infrastructure is to generate accounts of fire risk on a number of different aesthetic registers. The projections made inform strategic decision-making on how to intervene upon fire before they occur. The risk projections that are generated by this digital infrastructure facilitate and condition the appropriation and practice of anticipatory governance in the FRS.

In order to understand how calculations are undertaken and projections are generated, the digital infrastructure needs to be approached and conceptualised as an assemblage. This infrastructure needs to be acknowledged in its composition through a vast range of materially heterogeneous human and non-human entities, from digitalised data, fibre-optic cables, hardware, software to mundane organisational routines, experiential knowledge and various interfaces between human analysts and computers. Calculation and risk projections arise out of their situatedness within, and reliance upon, multiple mundane processes, which are constantly ongoing in the digital infrastructure and which entangle heterogeneous agential forces that inhabit the infrastructure. The calculative prowess of the digital infrastructure thus operates, as John Law (2002) would describe, through "fractional coherence", in which the singular function of a technology is produced through multiple related processes which surround the technology. In the case of the Fire and Rescue Service, then, the singular functionality of individual software, whose commercial licence has been purchased by the FRS, will depend on the overall multiplicity of the digital infrastructure within which it now operates. The possibilities and hopes that appropriating new software opens up for the FRS will only be realised through processes of localisation, which call forth and enrol different elements of a wider digital infrastructure into relations with the new software.

Not to be ignored are processes in which data used for calculation are collected. As I will go on to show, however, data cannot be considered singular in its material form. In other words, data are not only embedded in digitalised codes which are subject to computer processing. Neither are data, as suggested in recent literature (Ruppert, 2011; Beer and Burrows, 2013), passive in their agency. That is to say, data are not subjected to the whim of human analysts and technologies. The agency of this materially heterogeneous entity called 'data' is manifest in their effect on the digital infrastructure. Crucial to the deployment of new technologies, data underpin the expansion of the digital infrastructure and, in so doing, help to arrange and enact new forms of anticipatory governance.

Broadly speaking, the digital infrastructure of the FRS is brought into being by the relations forged between the different agential forces and materialities enrolled in its

composition. The relations found between different agents, as has been noted in literature on the rise of digital cultures (e.g., Beer, 2009), are both static and circulatory. For example, 'export' and 'import' functions cut across and coordinate the space of the FRS digital infrastructure. These functions could be pin-pointed on a map. Lines could be drawn outlining the connection between one software package and another package. However, the relations 'import' and 'export' functions enact are also witnessed through the movement of data these functions permit and the overall ordering of data circulation across the infrastructure. Relations within the digital infrastructure are thus brought to life by the mobilisation and circulation of data. In turn, how data moves is pivotal to the deployment of new digital technologies and thus ultimately to forms of anticipatory intervention.

The terms 'data mobilisation' and 'data circulation', however, cannot be treated as synonymous. A number of scholars explicitly state (Adey, 2006; Salter, 2013) that circulation and mobilisation express different forms of motion. Circulation accounts for the curves and trends moulded and re-shaped through routine movement happening in a specific space, the order of movement. Mobility, on the other hand, serves to designate the differential capacities of agents enrolled in circulation. Mobilisation refers to the enablement of a thing's movement. Mobility and circulation are not mutually opposing categories. Mobility works within and shapes circulation. Interventions take place to mobilise certain phenomena within circulatory curves to achieve particular effects.

The acquisition of software and its redeployment for new purposes in the FRS is a matter underpinned by how data get mobilised. Take, for instance, the case of credit checking data and its associated analysis software Experian MOSAIC. The data accrued, and the software designed to analyse the data, was initially used by the credit checking company Experian to profile populations in terms of consumer behaviour. The data and software were then sold to companies to inform target marketing campaigns. In the FRS, however, the database is used to establish risk profiles of those most vulnerable to fires. These risk profiles will inform the targeting of Home Fire Safety Checks (HFSCs), whereby FRS personnel visit houses to install fire alarms and educate about fire safety. The enactment of MOSAIC databases through HFSCs allows the FRS to prevent fires from occurring.

To become pertinent for risk profiling, lifestyle data that MOSAIC provides needs to be integrated with data on the spatial distribution of fires in the past. Import functions need to be established between MOSAIC and those databases that hold data on the geographical coordinates of previous fire incidents. On a computer screen, MOSAIC shows the distribution of lifestyles across a region in Britain. The region itself is articulated by the serialisation of occupations, ages, ethnicities alongside non-conventional demographic categories, such as where preferences for specific forms of entertainment prevail or the distribution of smokers. Superimposed onto this map is imagery which locates the occurrence of fires over the last three years. Through the integration of data, MOSAIC injects lifestyle variables within the causality of fire risk.

At the very heart of the functionality of MOSAIC in the FRS is thus the mobilisation of data and the establishing of circulatory regimes in which data are enrolled. The mobilisation of data, which enables the adoption of generic analysis technologies and their redeployment for specific governmental goals in the FRS, takes place under specific conditions. One such condition revolves around the similitude of data by their form. Uploading data on the spatial location of previous fire incidents is possible on the premise that such data are computable within MOSAIC software. In this case, data on previous incidents of fire must simply be digital. That which conditions the enrolment of data in mundane processes of technological redeployment or, in other words, mobilises data within broader circulatory regimes, is the form that data take.

The question of the material form of data and its capacity to mobilise and circulate has a rich lineage as Vismann (2011) shows. Discussing the consolidation of legislative power in Ancient Rome, she examines in depth the form that legislative files take. In particular, she discusses how scrolls were replaced by codices as devices for recording laws and precedents. This substitution, as Vismann (2011: 32) observes, took place for many reasons:

> The advantages of codices are, quite literally, there for everyone to see. The new reading posture offers readers an escape from the defenceless position of having both hands attached to the text. The emperor Domitian, for one, was unable to ward off his murderers because he was holding a scroll. Reading a codex requires one hand only- or a fist. The ability to quickly leaf through a text in both directions in search of a specific item is another obvious advantage of the codex … The possibility of adding further layers to the loose leaves prior to their binding frees codices from the purely diachronic recording logic of scrolls … By virtue of these optimized features – random access, up-to-date writing, ease of binding, storage and rearranging – codices gradually replaced scrolls as "functional texts".
>
> *(Vismann, 2011: 32)*

It is not only that form affects the mobilisation of specific data within wider circulatory regimes. Instead, following Vismann's observations, the form that data are shaped into, and what data come to inhabit, are matters interwoven with processes of accumulation by which governmental power can be both consolidated and can transform itself. The codex thus allows new leaves to be added. In the FRS, new data are continually sourced and new forms of technology, such as MOSAIC, are acquired. To be useful, however, it must be possible to fold this new data and technology into wider circulation processes of the FRS digital infrastructure. Through regimes of circulation, data of the same forms are enrolled and integrated with one another.

Although similitude in form conditions and organises data integration processes, the material form of data cannot be treated as fixed. In its integration and mobilisation together, heterogeneous data will take on whole new forms. I will return to this point in the next section, where I discuss the new modes of calculation that the acquisition of technologies like MOSAIC enable. Maintaining focus on mobilisation and circulation in this section, it is more immediately important to state that not all data bear a digital form. The heterogeneity of data forms under integration raises important points of consideration in terms of the relationship between mobilisation and circulation. Not only does mobilisation within broader regimes of circulation allow for an exploration of what is

mobilised and what is not, but also, through these two categories of movement, I explore what data are seen as mobilised and what data mobilisation is made invisible. Data circulation and mobilisation processes, which enable the redeployment of technology, are enwrapped here in a politics of absent-presence, by which data without digital form aid strategic decision-making, but outside of digital visibility and potentially outside of the laws of digital accountability, such as the 1998 *Data Protection Act*.

In the case of MOSAIC, data acquired through the integration of potential lifestyle distribution with fire location history is understood by analysts as an insufficient base for analysis. As gathered through interviews with them, the foundation for analysis offered by this data integration is perceived as "too wide in scope and not targeted enough" (interview 14 October 2011) to generate risk profiles. As the analyst went on to state, lack of depth makes possible the problem of rendering invisible those most vulnerable to fire. An example of this was offered hypothetically by one analyst when during an interview I was asked to imagine

> a little old lady … living on a street on her own. It's a fairly affluent street, the houses are relatively new … that person would be tagged with the profile of that entire street. But the little old lady sleeps in the dining room because she cannot get upstairs.

Through this analogy, the analyst argued that data that know populations at the level of broad categories cannot focus on particular activities that might amplify one's vulnerability to fire.

The problem cited by analysts works to justify the insertion of other data into risk profiling analysis. Specifically, data on fire location history and potential lifestyle distribution will be integrated with data concerning past instances in which individuals have died from fire. Produced from fire investigations, these data offer an account of the lifestyles of victims of fire. Qualitative in their expression, data deriving from fire investigations do not take the same form as other data used and thus complicate processes of data accumulation, which underpin the redeployment of MOSAIC in the FRS.

Another path of data circulation in the redeployment of MOSAIC thus reveals itself when considering the use of fire investigation data. Heretofore, algorithmically computable data enmesh through establishing import functions between databases. Deriving from another database, fire fatality data will not be integrated digitally with other data, but will instead be deployed by analysts to enhance the depth of analysis. Paper charts, for instance, which detail how many of those who have died from fires in the past were smokers, offer an insight not only into where specific lifestyles exist, but what makes these lifestyle dangerous. Alongside their manifestation in digital form, data of other forms enable the localisation of MOSAIC and its application for the specific purpose of profiling those most vulnerable to fire risk.

Fire fatality data, although taking a different form, are mobilised into and integrated with broader data circulation regimes that enable the redeployment of MOSAIC in the FRS.

This is possible because the FRS digital infrastructure, as noted above, cannot be understood as merely composed of hardware, software and other technological components. Rather, human agents contribute to affect processes by which risk analysis is made possible in the FRS. As evident in this case, the mobilisation of fire fatality data is dependent on analysts' intervention.

What becomes mobilised within data circulation and enables the redeployment of technologies results from the interplay between materially heterogeneous agents within the FRS digital infrastructure. As indicated earlier, however, the matter of the form that data take does not only allow for inquiry into what is mobilised within broader schemas of circulation. Instead, the mobilisation of data of different forms suggests that technological redeployment is also complicated by the question of what data are seen to be mobile and what are not.

The integration of fire fatality data into risk profiling analysis is vital to the success of MOSAIC's localisation into the FRS and gauging vulnerability to fire. Pertaining to specific individuals, however, the use of fire fatality data raises important issues around its use in risk profiling. The appearance of such data within the MOSAIC software would threaten to breach data privacy laws to which the FRS are subject. But fire fatality data are not integrated in the same way as other data used for risk profiling. Neither does the mobilisation of fire fatality data take place within and through circulatory regimes in which other data are enrolled. Although present in the construction of risk profiles, fire fatality data are absent from digital circulation processes that provide the basis for MOSAIC redeployment in the FRS. Fire fatality data are mobilised, but do not take the same form as other data. Through the mobilisation of data, which bear different forms, the FRS can evade legal complications arising from the use of fire fatality data.

The redeployment of technologies in and across the contemporary security apparatus, by which techniques of anticipatory governance extend their grasp over an expansive array of emergencies, opens up new pathways for critical exploration. This section has focused on how technological redeployment is shaped by mundane organisational processes that revolve around, and are engendered by, data. Broad data circulation processes within which data mobilise are vital to the malleability of the contemporary security apparatus. Critical evaluation of circulation processes rests on understanding data as a materially heterogeneous agent, whose form conditions the extent to which, in this case, authorities can gauge the vulnerability of populations and target anticipatory forms of intervention. The ability to appropriate and redeploy technologies does not rely merely on the mobilisation of heterogeneous data forms however. Rather, exploring data circulation and mobilisation also opens up space for insight into what data are seen to be used by those governing and what data are rendered invisible. The question of what is seen as mobile and what is not can lead to important questions around what legal issues technological redeployment opens up for organisations like the FRS. In the next section, I examine how technological redeployment is facilitated not only by how data move and what form data

take, but by what logics of calculation they engender when harnessed by governing bodies seeking to manage the future.

The temporal fixing of calculative imaginaries

The conditions of possibility for the redeployment of technologies are in part coordinated by a politics of mobilisation and visibility, which characterises data as they live in local contexts of the contemporary security apparatus. The mobilisation and accumulation of data, however, are not the only processes that actualise the redeployment of technologies for the purposes of the FRS. The functionality of the codex, to return to Vismann (2011), is evident in its re-engendering of the temporality by which data can be processed. A "purely diachronic logic" (2011: 32) is supplemented by a variety of new temporal arrangements with the emergence of the codex.

In the last section, I showed how the mobilisation of data was intimately bound to the issue of the form data take. However, means by which the form of data can be described go beyond their commonality or dissimilarity as digital artefacts. The data referred to above included data on the potential lifestyle characteristics of populations and their integration with data on past fire locations. One kind of data takes digital form and another exists in paper charts and in the experience of analysts. However, data can also be differentiated by its temporal reference to the past, present or future. In other words, data bear different modes of temporal address.

The temporal heterogeneity of data cannot be understood as an obstacle to technological redeployment in the FRS. Rather, the integration of different temporalities is foundational to the act of risk analysis. Analysing the future, rendering risks visible through calculation in the present, is an onto-epistemic performance, which relies upon and seeks to exploit the different temporal registers of data. In her discussion of "data derivatives", Amoore (2013: 52) argues that new modes of calculation that work with, rather than being adverse to, the uncertainty of the future amount to arraying relations between "an amalgam of disaggregated data". For Amoore, "new temporal arrangements for managing the uncertain future" (2013: 61) are enacted and performed by the integration of heterogeneous data and the forms of calculation enabled.

To return to the example of risk profiling, the futures presented through analysis are underpinned by different configurations of the relations between data. At a rather rudimentary level, the analysis that MOSAIC permits could be undertaken through a simple correlation between two different temporal moments that data integration has made possible. Previous fire distribution could thus be compared against potential lifestyle distribution. This correlative analysis permits analysts to infer whether previous fires have anything to do with lifestyle. Although an important foundation to build analysis upon, this simple correlative temporal fix that MOSAIC actualises will not suffice to inform the construction of risk profiles. Demonstrating this correlation through MOSAIC, the analyst narrated a disjuncture between potential distribution of lifestyle and previous fire location (interview 14 October 2011). On the lifestyle map MOSAIC presents, the location of fires

cut across areas of multiple different lifestyles, making the vulnerability of particular lifestyle groups to fire a matter of ambiguity.

The problem named by the analyst is only recognised as such because of the strategies of intervention that risk analysis will inform in the FRS. Targeting on the basis of previous fire locations would be justifiable if the FRS itself sought to react to fire in its known previous distribution. To do so, however, would be to belie the hope that MOSAIC and lifestyle data embody; a hope that this technology and these data hold within them the capacity to secure the future in the now. Enacting governance in anticipation of fire requires that previous fire location data need to be mobilised in analysis in a way that identifies fire in its future proclivity as a risk. As a technology redeployed to practice a new governing rationale premised on potential, the calculations MOSAIC performs must be based on temporal configurations, which hold that past fire incidents render a location vulnerable to future incidents.

Engendering anticipatory forms of governance requires new temporal arrangements to coordinate the calculative practices by which fire risk is made sense of. Simple correlation between the past and future is not sufficient for knowing future fire risk. Neither is such correlative reasoning, in turn, sufficient for informing the targeted deployment of preventative resources. In the case of MOSAIC, instead, what is known as over-representation analysis will take place. On an *Excel* spreadsheet, the population of the region is aggregated into lifestyle groups. Alongside this aggregation appears the amount of fires that have occurred within this lifestyle group. Vulnerable lifestyle characteristics will be identified where fire's percentage exceeds the percentage proportion of a particular lifestyle group.

Over-representation analysis creates and performs a new temporal relation between disparate data that have been integrated. Data which capture the potential lifestyle of populations and data on past incidents of fire are not treated as two separate, albeit inter-related, entities offering correlative insight. What over-representation analysis does, instead, is play on the capacity and value of different data to be inhabited by each other. Through over-representation analysis the two forms of temporal registers that data in this instance address are moulded together.

The result of this enmeshing of heterogeneous data is the formation of a whole new temporal register, which both affects how the emergency of fire is imagined and calls forth and facilitates new forms of government. The temporal register constructed works to project into the future, but in a way that is harboured in, and anchored by, past experience. In other words, the temporal fix established through the mobilisation of data in over-representation analysis is but one way by which to capture the risk of fire by its *emergence*.

To capture the emergence of fire, the forms of calculation enacted in the FRS must operate on the basis of contingency. Specifically, the re-problematisation of fire governance under an anticipatory logic means that fire must be known by its quotidian patterns, but

only insofar as to gauge where, why and how such a rigid pattern might fail. Rather than looking for correlation which speaks of continuity, calculative techniques deployed under anticipatory forms of governance must seek to emphasise the possible breakage of normative order. Data on potential lifestyles thus serves to disrupt and render precarious fire trends; trends visualised through fire location data. Through analysing it in relation to lifestyle distribution, the stabilised trend of fire distribution has an aleatory event written into it. Lifestyle calculation seeks to throw a spanner in the works, or, more appropriately, a smoking cigarette of those who belong to a lifestyle group associated with smoking that is left on a sofa. The emergent character of fire is invoked through arranging data bearing different temporal modes of address to one another. Data on potential lifestyles are used to render contingent fire trends acquired from data on fire incident location in the past.

The redeployment of technologies through which the localisation of anticipatory modes of governance is facilitated has been treated in terms of the new forms of calculation new technologies open up. The differential temporal address of data has been pivotal to my examination. I have shown how the temporal heterogeneity of data mobilised is not a problem for the localisation of anticipatory governance measures to the banal risk of fire. Rather, this temporal heterogeneity is vital to the relational ontology that engenders risk projections. Forms of calculation, as Amoore (2013) shows, are underpinned by an array of relations made between data which bear disparate temporal referents. The relations performed through analysis of data generate new temporalities, which intersect between past and future to envision the potential emergence of events. In the last section, I consider my observations regarding technological redeployment and the localisation of governance in relation to broader shifts in the governing rationale of the UK Fire and Rescue Service in the twenty-first century.

Conclusion: entrepreneurial agents of security

In an age where data and calculative technologies attain an increasing influence in practices of governance, a politics of technological redeployment shapes and conditions authorities involved in an anticipatory security apparatus, whose application incrementally extends to new domains. Software, hardware and data are malleable and subject to localisation to meet specific governmental ends. In other words, such digital entities must undergo transformation to adapt to new organisation sites and spaces before facilitating the enactment of new modes of governance. Critical accounts of data-driven governance, as I have suggested in this chapter, must examine the mundane organisational routines, practices and processes that facilitate technological redeployment. In the case of the FRS, redeployment instigates new flows of data circulation and calculation, which, in turn, shape practices through which the FRS acts upon futures yet to occur.

The broader context within which processes of technological redeployment are posited extend to the very ordering of the wider global information network itself. Being actualised through universally available software and data, the conditions of possibility for the development of new modes of governance depend in no small part on the dis-embedded nature of data flows and the technologies that orient these flows across space. The harnessing of these devices in the FRS is certainly wrought, as has been shown here, by legal and ethical complications. The ramifications of drawing upon dis-embedded data flows seem to be shared by other organisations, as the case of the NSA PRISM programme and its implications suggests (e.g., *The Washington Post*, 7 June 2013).

But the similarities between the NSA PRISM programme and the case of the FRS go further. In both instances, ethical complications arise where questions attend to where data come from, the form that data take, how data are made sense of through calculation and how data are mobilised in actualising an emergent future. But the reliance of the FRS upon open global data flows and commercially available technologies raises another question; a preliminary response to which I will conclude with. In relation to the processes of technological redeployment described above, the question is where does authority exist across this network of informational flows and calculative devices that provide the grounds for security in the twenty-first century?

In her book *'Speculative Security',* Marieke de Goede understands this problem of where authority lies to be best comprehended through the notion of public-private assemblages (2012: 86–89). Accounting for the multitude of relations which necessarily prevail across and between governing agents where security takes an anticipatory turn, the public-private assemblage has many consequences for any critical analysis of power-laden calculative devices. This public-private assemblage could be used, for instance, to trace the movement of data within a nexus of informational flows and intersections that reconfigure global space-time.

The affordances of the public-private assemblage also extend to opening up for critique the possibility of role confusion between public and private agencies enrolled in this assemblage. In the case de Goede (2012) elaborates upon, the private concerns and interests of banks entangle and influence public law enforcement issues, where data on monetary circulation are used to track people suspected to be potential terrorists in the war on terror. The question the public-private assemblage can instigate here does not merely revolve around the matter of where authority lies, but how the interests of different related actors impose on one another and what the result is for how those governing rationalise and justify the operations they undertake.

As has been documented, processes of technological redeployment in the FRS are enveloped within, and indeed facilitate, a wider organisational change, whereby the FRS has become anticipatory in its operation. But redeployment is also pivotal to another operational shift in process in the FRS; a new governing arrangement referred in the UK as localism. In a manoeuvre, which resonates profoundly with Foucault's (2007) notion of governmentality, where power is diffuse and nestles in disparate sites, the *2011 Localism Act* draws the FRS further away from centralised control and into local control. As the then Minister Greg Clarke (2011) stated, a key motivation for localism at the time of the Act introduction was the supposed eradication of bureaucracy in government:

> For too long, central government has hoarded and concentrated power. Trying to improve people's lives by imposing decisions, setting targets and demanding inspection from Whitehall simply doesn't work. It creates bureaucracy.
>
> *(Clarke, Department for Local Communities and Government, 2011: 2)*

But the effects of localism on the FRS could be read in an entirely different way. Detaching the FRS from central government more than ever before, the *Localism Act* situates responsibility for the existence of fire governance more fervently on each individual FRS in the country. A situation is created through localism in which, as Paul Du Gay writes, ''organisations are to be made more responsible for securing their own future survival and well-being" (2003: 673).

With the ushering in of the *Localism Act*, the FRS is necessarily forced to become more entrepreneurial. The FRS must be seen to earn its central budgetary subsistence, rather than simply receiving it. To do so, the FRS must justify its continuing existence through showing the ongoing prevalence of fire risk. In addition, the FRS must be able to evoke the consequences should their budgets be cut dramatically. Consider the following from the County Durham and Darlington Fire and Rescue Services Consultation for their 2014/15 Community Protection Plan:

> The option of reducing frontline services would inevitably not only impact on emergency response but also significantly reduce the capacity of the organisation to deliver prevention and protection activities, which have been a major contributor to the reduction in emergency incidents we attend.
>
> *(County Durham and Darlington Fire and Rescue Service, 2014: 14)*

With the becoming entrepreneurial of the FRS, the potentiality of fire and fire risk itself becomes the fundamental commodity, which is continually sold and resold to central

government. Risk projections and the capacity of the FRS to govern the future are reliant, as the discussion in this chapter suggests, upon technologies acquired from a host of sites and redeployed for the purposes of the FRS. The malleability of risk analysis technologies works to facilitate and condition the entrepreneurial spirit with which the FRS is infused after localism.

In the case of localism legislation and its resonance in the FRS, the notion of public-private assemblages can be envisioned not only as a scale across which authority moves or throughout which authority exists at different degrees of intensity. Apparent with localism is also the internalisation of an entrepreneurial spirit in the FRS; one conventionally reserved for private business. Calculative software and data are vital to the life of this new intersection between public and private that localism instigates. Such technologies offer visions of the future by which risk is not only governed, but, by acting to justify the existence of the FRS, sold.

A politics of redeployment does not only refer then to the creation of new modes of action, which derive from the sourcing of new data or adding to the preexisting risk calculus. Nor does it refer simply to the manipulation of technologies to engender change in the multiple sites of the security apparatus. Rather, it also means to declare the effect of new calculative technologies upon emergency responders in reshaping how their responsibilities are rationalised and their continued existence is ensured.

Note

1 For a comprehensive overview see: Amoore L. and M. de Goede (eds). *Risk and the War on Terror*. London: Routledge, 2008.

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5

Seeing the Invisible Algorithm

The practical politics of tracking the credit trackers

Joe Deville and Lonneke van der Velden

> To do a sociology of the invisible means to take on the erasing process as the central human behaviour of concern, and then to track that comparatively across domains. This is, in the end, a profoundly political process, since so many forms of social control rely on the erasure or silencing of various workers, on deleting their work from representations of the work.
>
> *(Star, 1991: 281)*

Introduction

Susan Leigh Star (1991) captures a central concern of much politically sensitive academic practice: how to make that, which is rendered invisible, visible. There is a politics to that which is unseen, in which forms of what she calls "social control" become tied to the erasure of the practical activities – the forms of work – that go into making and stabilising the domains of the visible.[1]

We follow the spirit of Star's call for a sociology of the invisible, but our focus is not on human labour, but the labour of machines: the automated, unseen, digital work undertaken by 'trackers' (other terms include 'bugs', 'pixels', 'tags'). These are online data gathering tools, many provided by third party providers, activated when a user visits a particular website. They form part of what has been called the 'invisible web'. Many of us are familiar with the way in which cookies are placed in our browsers. Cookies, however, are only one of a range of tracking devices that are deployed by tracking and advertising companies. When they are activated, content provided by a third party is loaded onto the website in question (even if it remains unseen; in some cases, this content can even import new trackers, so called '4th party content'). In the case we will consider in this chapter, the data gathered by these devices are being turned towards a quite specific form of algorithmic calculation (Gerlitz and Helmond, 2013; Helmond, 2013).

There is more we can draw from Star. In pursuing the sociology of the invisible, Star calls for a process of "comparative tracking". We have followed this injunction by seeking to track and compare the tracking devices that are tracking us – a project of "tracker tracking" (Castellucia, Grumbach, and Olejnik, 2013; Gerlitz and Helmond, 2013; Koot, 2012; Tran et al., 2012). This has involved not only comparing empirical objects, but also comparing changing 'tracking toolkits'.

Our set of empirical objects cluster around a phenomenon that we call 'digital subprime'.[2] This is a new variant of online consumer credit lending grounded in the exploitation of diverse data to predict the behaviour of individuals, and, in particular, the likelihood of subprime borrowers repaying subprime loans.[3] Its work can be seen to exhibit a degree of continuity with similar activities in a range of different online settings. Amazon, Facebook, Google, Netflix and many more besides are each routinely acquiring, analysing and making use of more or less willingly released personal online data (Bollier, 2010; van Dijck and Poell, 2013; Hoofnagle et al., 2012).

Though we will touch on some of the issues that arise from the proliferation of this new form of credit, the chapter's principal focus is on how we might hold this object steady in the first place. Drawing on the results from a pilot project, its focus is on how we might seek to understand with more precision, and *from the outside*, the work being done by forms of online algorithmic calculation. This, then, is an analysis of some of the practical politics entailed by the production of knowledge about algorithmic behaviour. What does it

mean to try to understand an (proprietary) algorithm from the outside? What are the limits and opportunities? What calculative practices lend themselves to being rendered visible, which cannot? Through which different registers can questions of visibility and transparency be articulated? Our answers to these questions sit in dialogue with the emerging field interested in the politics of knowledge production associated with a variety of digital methods (see Marres, 2012; Borra and Rieder, 2014; Weltevrede n.d.).

Encountering digital subprime

Readers in the UK will likely be well aware of the UK's largest digital subprime company, even if they may not recognise it as such. It is Wonga, the most controversial of the UK's growing number of providers of so-called 'payday loans' or 'short-term credit' (the preferred industry term). These loans are relatively low in value – £400 is the current Wonga maximum for first time customers (Wonga, 2014a) – and are usually due to be repaid within a month. They are also expensive, with a Wonga loan currently repayable at 1,509 per cent APR. This, however, is a lot less than it used to be; a cap on interest rates introduced at the start of 2015 has pushed down the cost of its loans from an eye-watering 5,843 per cent. Before this, it was by far the most expensive UK payday lender, which led to much criticism. Most famously, the current Archbishop of Canterbury drew parallels to historical practices of usury (Mendick, 2012).

Its historically higher than average APR aside, there are two further elements that make Wonga near-unique in the UK and especially relevant to our concerns here.[4] The first is its proprietary in-house credit scoring system. Wonga claims that by sorting through up to 8,000 different data points (Wonga, 2014a), it is particularly good at sorting borrowers who will repay from those who will not. The second is Wonga's speed. Credit decisions are fully automated, with cash being delivered into customers' bank accounts five minutes after approval (Wonga, 2014b). This has an important consequence: Wonga is dependent on data that is available more or less instantly.

Given the overall themes of this edited volume, we will not detail here why Wonga might be interested in such a large number of data points. Suffice it to say that, when it comes to its particular form of risk-oriented algorithmic calculation, it is important that the data it is able to access is as plentiful and diverse as possible. It is also worth noting at this point the specific form of credit-consumption that is engendered by such sites. All payday lenders, including Wonga, depend, like 'mainstream', less 'fringe' forms of credit,[5] on a user's credit rating(s).[6] However, payday lenders' very positioning as less concerned with their users' institutionalised credit standing marks this territory out as somewhat distinct from their less controversial creditor cousins (credit card issuers, banks issuing personal loans, etc.). To a degree, then, this renders the credit score and its ongoing management (e.g., Langley, 2014; Marron, 2009) a less relevant concern for borrowers using payday lending services. More significant for the present analysis is the fact that, if potential borrowers were minded to look into the basis of Wonga's particular method of credit assessment, they might quickly realise that their credit score matters even less than is the case with some of Wonga's payday lender rivals. For, while Wonga buys credit reference data, and supplements this with other commercially available data,[7] it claims its own scores, only *partially* composed from this data, are "unbelievably" and "dramatically" more predictive than those provided by third parties (Shaw, 2011). This seems to suggest that

Wonga, a relatively small, relatively new company, is – in this particular section of the consumer credit market at least – doing better than an industry that has spent decades trying to master such methods.

As with many other payday lending websites, Wonga's homepage is dominated by a twin device designed to facilitate customer calculation: two 'sliders', whose movement affect both the size of the loan and its duration. These sliders and, specifically, the way they moved during the phase in which we were conducting our initial research, provided our first way into rendering visible some of invisible processes Wonga was and still is undertaking that make it, in fact, quite different from many of its rivals. Using some rough experimentation, it was, when we began our investigations in 2013, possible to demonstrate that the *starting* position of Wonga's sliders – that is the position that the sliders are set at when a user visits the site – was not constant (we would encourage readers to experiment!). Their starting point was affected by a number of conditions, relating to data that is released by the visitor, perhaps without them fully realising it. This is what one could call "leaked" data (Chun, 10 October 2013; Rogers, 2013). One major factor in this variance was the particular browser being used – so, for instance, Firefox as compared to Internet Explorer. This might seem a highly mundane variable; however, analysts have shown how it is in fact possible to map a user's choice of browser with their particular spending habits (Qubit, 2013; we will return to this later). Another seemingly important driver of this variance was the user's IP address, which provides a rough indication of the user's location. And finally, repeat visits to the site, measured using cookies, had an effect on the repayment time bar, with more visits pushing it downwards.

This has now (early 2015) changed. The sliders no longer move pre-emptively. We can speculate that Wonga was experimenting with a novel technology and, for whatever reason, decided not to pursue this further. Irrespective of this, by opening a brief window into Wonga's algorithmically-driven processes, we have succeeded in rendering an aspect of its 'behind the scenes' practices visible. We can draw tentative conclusions about what we were observing. We can be reasonably confident that this shifting behaviour revealed that Wonga was undertaking a process of customer "segmentation", by which people are sorted out according to their expected consumption behaviour (Seaver, 2012; Zuiderveen Borgesius, 2014). However, because of the fact that the algorithm driving this movement was and still is hidden from view, we cannot draw firm conclusions about the exact reasons for this segmentation. We can provide some hypotheses: first, that the starting position of the loan amount could be understood as a kind of base level loan for a user – an algorithmically driven, rough and undeclared confidence vote in the potential borrower. It would follow that Wonga was trying to encourage broadly 'riskier' borrowers, a measure arrived at by combining various elements of their leaked data, not to ask for too much, therefore potentially improving the chance of their application being successful. The movement in the repayment time, in turn, would be aimed at making loan being offered ever cheaper. We might hypothesise in this case that the site was experimenting with

enticing hesitant borrowers, those who were making multiple visits to the site, but not following through with an application, to go ahead. In effect, what we would be seeing here, then, was the offer of a different credit product to different types of people, potentially at different points in a purchasing/borrowing trajectory.

This analysis of the condition-dependent movement of the slider, then, while not providing access to the full epistemological underpinnings of the algorithm, does render visible some of its *ontological effects*. Experimentation is thus one way of chipping away at the opacities surrounding certain forms of algorithmic apparatus. While in some domains of academic social research the art of deploying this tool has been lost, when it comes to algorithmic opacity, it may be crucial. Furthermore, even if precisely how the various data being collected are analysed and deployed is currently opaque (although our experiments are ongoing), and if the registers of visibility of these processes are changing over time, we have been able to show that certain online, leaked data – including location, as measured by IP address, frequency of visit, and browser type – are being used and combined in order to stand as very quick, very rough proxies for an individual.

We may also venture a stronger claim: that this kind of mundane, 'leaked' data is of interest to Wonga not only when deciding what credit products to offer to potential borrowers, but also in its process of conducting credit assessments once an application has been made. We have had this confirmed to us by an industry source, familiar with Wonga's systems.[8] Wonga are not alone in this respect. It also has an international rival called Kreditech, which is preparing to launch new payday loan sites in Australia and across Eastern Europe and Central and Southern America, to add to existing sites in the Czech Republic, Poland and Spain (Kreditech, 2013a). It specialises in what it calls "big data scoring" and claims to assess potential borrowers by even more data points than Wonga (10,000) (Kreditech, 2013b), using data derived from "social networking sites and online tracking" (Kreditech, 2013c). Similar companies are ThinkFinance (USA; UK) and Zestfinance (US). The mantra of Zestfinance encapsulates the promise of data for all of these organisations: that "all data is credit data". Its approach is summarised in a talk given by one of its co-founders, Douglas Merril (it should be noted that, different to Wonga, Zestfinance claim that their use of data can help bring down the costs of subprime borrowing):

> It turns out that there are hundreds of sources of data, trivially available on the net. And thousands if you include things like web-crawls etc. And if your view is that all data is credit data, you build a piece of mathematics, or in our case a whole bunch of mathematics, that consumes thousands of data points. And of those thousands many are missing, many are wrong, etc, but regardless you build a score. And suddenly you build a score that allows you to figure out people who are maybe not quite good enough to get a subprime credit card, but are a way better credit risk than the payday loan guys. So instead of offering them a 700% APR borrowing [sic], you can offer them something in-between.
>
> *(Merrill, 2012)*

Different goals aside, what these sites share is the scraping of vast amounts of data that could be tied to the *identity* of a potential borrower, which is duly filtered and then acted

upon through apparatuses of algorithmic calculation in order to make predictions about the *behaviour* of those borrowers.

In examining these largely opaque practices, however, what tools might be used in addition to experimentation? How might we situate their methodological promise?

Registers of (in)visibility and the *'Tracker Tracker'*

Even before the revelations that followed Edward Snowden's release of National Security Agency's (NSA) files, online tracking and behavioural profiling by online corporations started to emerge as a public concern.[9] Users have become accustomed to cookies being placed in their browsers (whether with their consent or not), to personalised search results and to advertisements for particular products following them as they browse online.

In a sense, then, the ubiquity of online tracking has already achieved a measure of visibility amongst even a non-expert online audience. Counterstrategies range from the simple (e.g., deleting browser caches, using ad blockers or browser's inbuilt private browsing facilities) to the more sophisticated (e.g., using VPNs and other online anonymity software (e.g., *Tor*)), to protect or obfuscate communication (Raley, 2013).These strategies are less concerned with rendering the invisible visible, than with blocking the effects of technologies assumed to be operating in the background, unseen.

There is a further strand within user-led counterstrategies whose explicit focus is on making visible, in real time, the much more specific processes of online tracking. A number of tools and browser plugins have been developed, with the focus not on the achievement of anonymity *per se*, but rather on changing the online browsing experience, so as to amplify the user's *awareness* of the tracking technologies that are in operation, while also potentially giving the user the option of impeding their operations.[10] These tools pull an invisible market of data sharing direct to the screen, while expecting the user to act on and play with this information.[11] They therefore engage in a particular repertoire of transparency that assumes that getting people to see these third party connections will stimulate a different info-aware behaviour. We will not dwell here on the question of whether these tools are successful in their aims. We are interested, instead, in what the tools can do for the inquisitive social scientist. For, given their attention to making visible the specificities of online tracking, they also can be turned into tools for keeping track of trackers; into 'tracker trackers', in other words.

In our research, we have drawn on one tool in particular, called *Ghostery*.[12] *Ghostery* is a tracker detector, owned by a company called Evidon, which, according to their own framing, "shows you the invisible web".[13] After a user installs the plugin in their browser, it provides a drop-down display listing the third party trackers that *Ghostery* detects in the web page being visited. It also provides the user with the option to stop these trackers from running – to block them, in other words. *Ghostery* works by consulting a 'library of trackers' that Evidon has built up, in part by some of its users having opted to share the trackers detected during their browsing sessions to it. At the time of writing, the library contains information about more than 26 million websites, 1,600 companies and 4,100 different types of trackers.[14] On the basis of its data, Evidon is able to rank the most frequent occurring trackers on the web, which it visualises as a periodic table of trackers

that updated on a bi-weekly basis (Figure 5.1).[15]

For the social scientist, the appeal of such repositories is that they contain rich information about a practice, access to which would otherwise be highly technically challenging. While third party trackers can be detected manually (Koot, 2012), doing this on a large scale requires both considerable time and a high degree of programming skill. Moreover, given the sheer volume of trackers and their rapidly changing configurations, an individual researcher would struggle to keep track of them. The use of such technologies is not without its issues. In using such tools, researchers are delegating part of the assembly of the empirical space s/he is intervening in to a third party (Marres, 2012). Moreover, they produce very particular epistemological affordances, being situated in particular device cultures (Rogers et al., 2013). In our case, this is partly a result of the fact that Evidon's database is dependent on being populated by *Ghostery's* user population. We are also dependent on how information is indexed in *Ghostery's* library. For instance, we are interested in identifying commonalities amongst different 'types' of data being collected by these trackers. These 'data types' are categories including browser information, date and time, demographic data, hardware type, page views, and IP address. Their categorisation is the result of a manual process, in which Evidon employees group trackers according to their publicly accessible privacy policies. The transparency that *Ghostery* enacts is, therefore, inevitably partial and mediated.

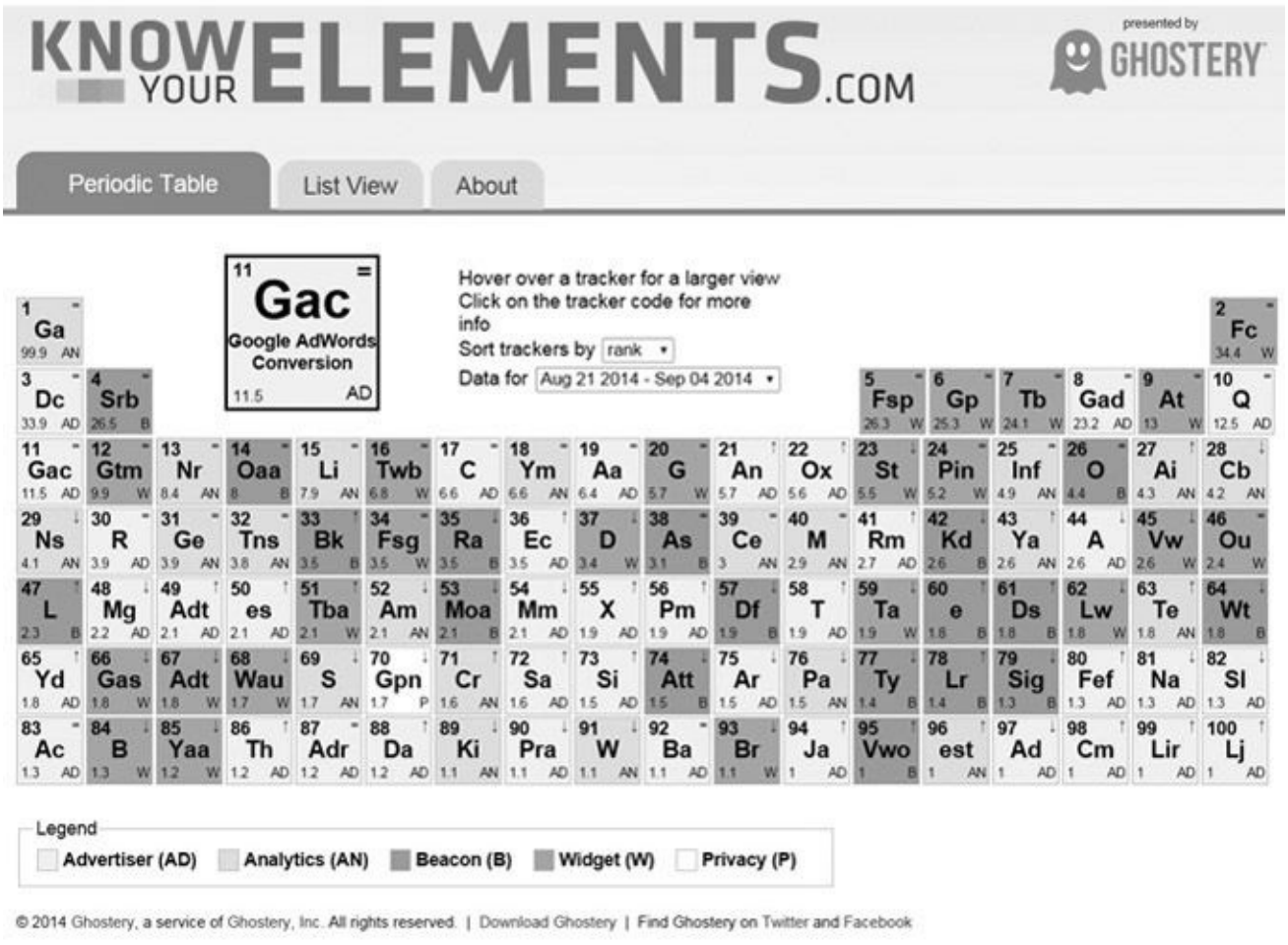


Figure 5.1 Know your elements: *Ghostery s* tracker ranking visualisation

The particular way we make use of the *Ghostery* plugin has emerged as part of a collaborative project undertaken with the Digital Methods Initiative (DMI) at the University of Amsterdam.[16] The DMI repurposes existing web devices for social and cultural research (Rogers, 2013). Examples of digital methods projects include scraping Google and Twitter for social data (Marres and Weltevrede, 2013), edit-scrapers in Wikipedia in order to follow controversies (Rogers and Sendijarevic, 2012), and software for co-link analysis to map the composition of issues on the web (Marres, 2005).

One of the tools developed by DMI researchers and developers that we have drawn on (and contributed to the ongoing development of) is the *'Tracker Tracker'*. The *Tracker Tracker* repurposes *Ghostery's* method of detecting and ordering trackers: it inspects web pages for particular traces of trackers (scripts) and compares them with *Ghostery's* database. In addition, its interface allows the researcher to insert multiple websites (urls) for inspection. The results of this analysis are made available to users in a spreadsheet that facilitates the systematic comparison of the trackers found. This can reveal which websites share similar third party trackers and also which companies are main actors within this – usually – invisible "fabric of the web" (Gerlitz and Helmond, 2013: 1349).

Early research into the accuracy of the *Tracker Tracker* has been promising: a recent study (Van der Velden, 2014) used the tool to simultaneously research a dataset of 1100 URLS being investigated by another researcher, using a method for automatic browsing (Koot, 2012). The results were found to be almost identical.[17] Other related digital methods projects have, by using *Ghostery's* library, been looking more deeply into the trackers themselves with respect to what kind of data these technologies collect. These research projects have tried to 'characterise' the trackers, for instance in a Glossary of Trackers that, inspired by the life sciences, maps the behaviour of trackers.[18] Our study builds on such work, but differs from it in a number of crucial respects, as we will now proceed to outline, while looking at how we coupled it to particular strategies of visualisation.

Rendering visible digital subprime's tracking toolkits

When trying to render visible commercial forms of algorithmic calculation, a major challenge is their proprietary status. The opacities of algorithmic calculation are therefore deeply entwined with the logics of intellectual property. We have sought to overcome this challenge by moving from a focus on individual companies to a generalised industry. We are less interested in the specifics of individual companies' algorithms than in more generalised *tendencies* in the basis of algorithmic calculation across the industry.

The basic logic and promise of algorithmic calculation and econometric analysis are well understood by researchers: that, through the analysis of large datasets, individual variables, or combinations of variables, may be found that hold predictive power (e.g., Deville, 2012; Seaver, 2012). When it comes to digital subprime, what is less well understood is what the basis for such calculations are. Put simply, what *kinds* of data are digital subprime sites interested in?

Our pilot dataset consisted of seven websites, three owned by Wonga – including in the UK, Canada and South Africa – three European sites run by Kreditech – and one in the US run by Zestfinance. This is a small dataset, compared to other tracker research (for instance, Gerlitz and Helmond (2013) and Van der Velden (2014) use about a thousand sources). However, in this project the *Tracker Tracker* performs a different function: instead of looking into the larger networks and the actors within them, it acts as a way of rendering visible tendencies and commonalities in the tracking work being done by digital subprime sites, which, in turn, can provide the stimulus for delving deeper into the role specific trackers are playing. In our case, we also checked the tool's output by running manual sweeps on each of the websites, including collecting trackers present on the application page of a particular site, which may be missed by the *Tracker Tracker's* analysis.

Figure 5.2 Tracker tracking preliminary results, July vs. November, 2013

The first step in our project was to measure the trackers on a dataset of digital subprime websites at two separate points in time (July and November 2013) and then to simply count the 'kinds of data' that we encountered. To do so, we employed *Ghostery's* categorisation, as outlined above. The results (Figure 5.2) reveal that, for these seven websites, trackers involved in the collection of browser information featured most prominently (60 times) as a collected data type. We already knew from our initial experiments with Wonga that different browser types were affecting the slider position. Here we see an interest in browser information across the sector. Other prominent data types include the date and time of a visit, as well as the users' IP address and hardware/software type. From conversations with those working in the industry we know that these are of potential interest to those working within digital subprime; here we can begin to render this interest visible.

In this short pilot experiment, however, we have been left with as many questions as answers: what accounts for the broad increase in trackers being used across the sector? Is this a general upward trend, or an anomaly? How do *Ghostery's* categories translate into what data is being *actually* connected. For instance, the results show trackers being involved in the collection of phone numbers (e.g., from mobile devices) – however, this

may well relate to particular online telephony services, or to when phone numbers are volunteered by users.[19] Similarly, any demographic data being collected may not necessarily be able to be tied down to the level of the individual.[20] Moreover, there references to PII (Personally Identifiable Information) connect the categories to a particular term within US legal discourse – in Europe the preferred category is 'personal data' and does not necessarily refer to the same kinds of data (Borgesius, 2013). To a degree, then, these results are a prompt for further research.

That said, there are further ways in which this data can be set to work. By tracker tracking, we have been able to begin to develop profiles of both the work that individual trackers are undertaking, as well as the particular forms of tracking each website may be mobilising by *combining* individual trackers. For each is involved in a quite distinct form of "socio-technical knitting", drawing on Jose Ossandon's term (Ossandon, 8 July 2013). That is, they are pulling together different online strands to each compose unique invisible 'tracking fabrics'. The question, however, is how to render this quite abstract, technical work visible and communicable.

For this, we can also turn to Ossandon. In some research on the ways that credit cards are passed between individuals and households in Chile, Ossandon (2012) asked his participants to map the whereabouts of their retail cards by pinning down woollen threads. Here some of the knitted socio-economic relations surrounding credit in Chile become visible and different profiles of movement comparable. In our case, the socio-economic knitting is undertaken not just by people but also by quite specific combinations of trackers. Trackers can each be seen as unseen, fully automated 'toolkits' that knit together unique assemblies of data points about internet users. We like using the concept of socio-technical knitting to describe the activity of credit trackers, because it renders the usually unseen and often apparently immaterial work of tracking more 'tactile', while allowing us to imagine how different patterns can emerge from their work. We have thus drawn on this metaphor in our attempts to visualise what is usually hidden, in order to construct distinct 'profiles' both of tracking toolkits and individual subprime websites. In so doing, we have worked with Frederica Bardelli and Carlo de Gaetano, designers at the Density Design Lab in Milan, who are experimenting with various ways to visualise digital relations.

Profiling trackers and digital subprime sites

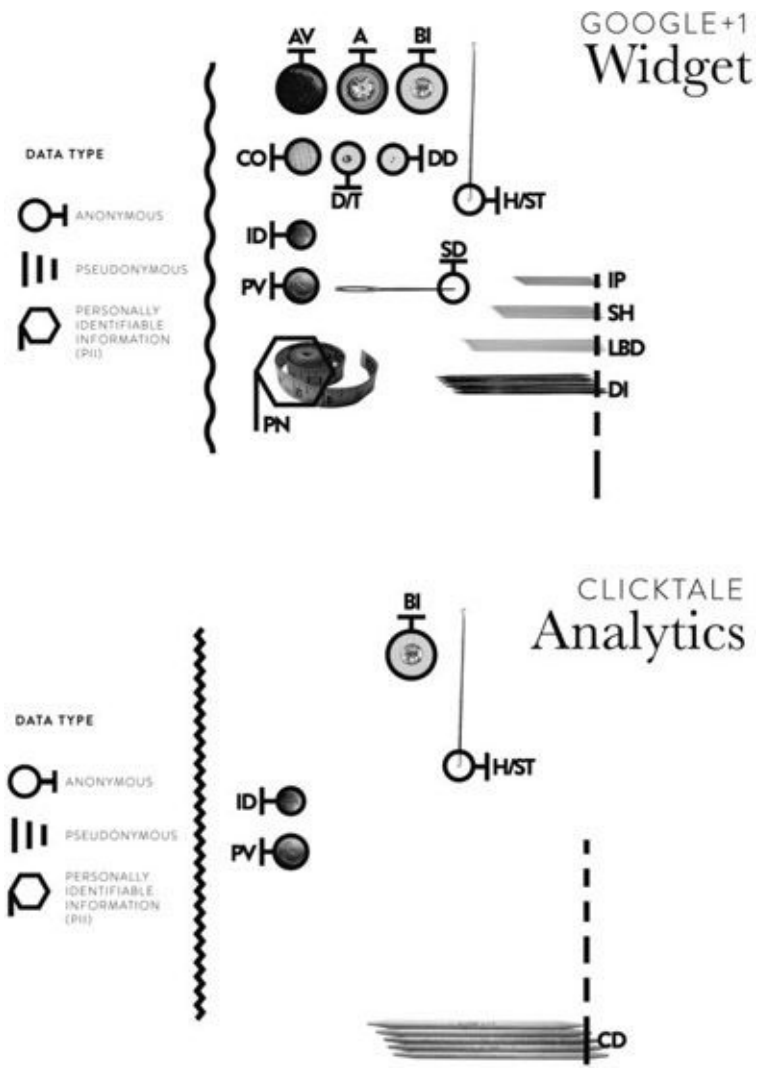


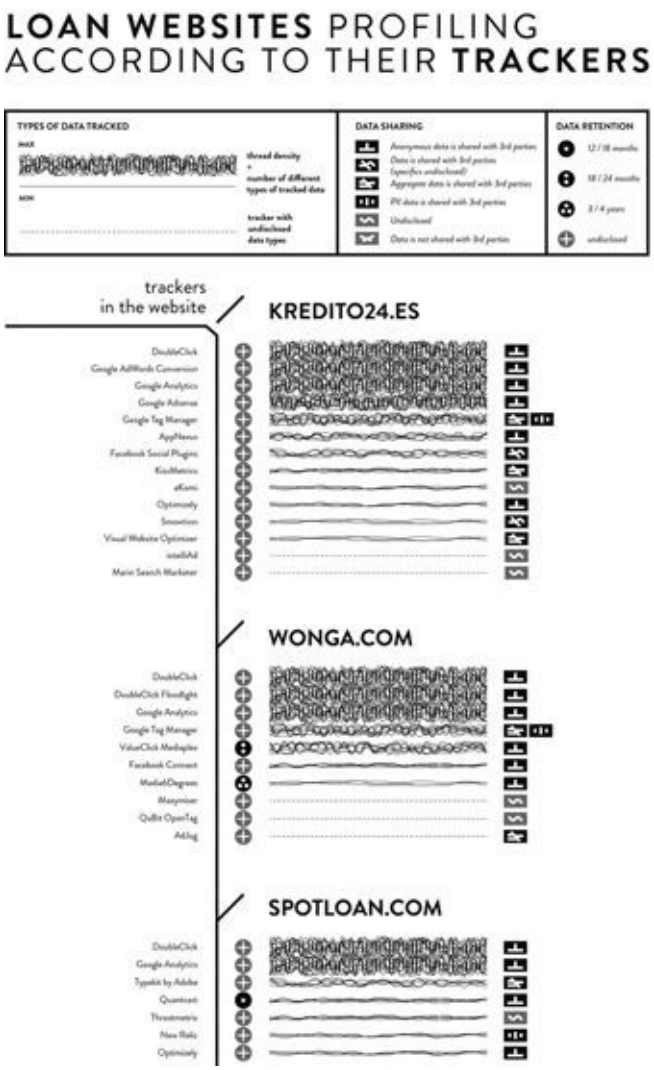
Figure 5.3 Comparing individual tracker profiles

Some of our initial collaborative outputs are presented below. Figure 5.3 shows a profile of particular tracking toolkits, listing the different kinds of data that they can collect. Each component in the toolkit stands for the collection of different data types. For example, in the visualisation of the Google+ widget, the buttons on the top row stand for 'Ad Views' (AV), 'Analytics' (A), and 'Browser Information' (BI). The second row contains buttons representing 'Cookie Data' (CO), 'Date/Time' (D/T) and 'Demographic Data' (DD). The measuring tape stands for the collection of phone numbers and the black knitting needles towards the bottom-right stand for 'Device ID' (DI). These visualisations tell us that in order for companies to engage in online profiling, trackers need to stitch cookies into your browser, pin down your device ID, and obtain browser information and information about the date and time of a visit. Through these methods trackers can weave data together into more or less personal profiles. In order to give some indication of how personal this gets, the legend on the left side of the image shows three different symbols, each of which represents a sort of data: Anonymous, Pseudonymous and Personally Identifiable Data (PII) (these draw on *Ghostery's* own categorisations).

One of the results of these trackers-as-toolkits visualisations is that, when placed next to one another, they render more immediately visible the differing levels of sophistication possess by different trackers; here, for instance, how the Google+ tracker deploys a far greater variety of different ways to collect data than Clicktale.

This profiling of individual trackers has generic applicability. More specific to our research object is the profiling of how different digital subprime sites bring different trackers together. Three examples are shown (Figure 5.4). Each website is represented by a section of fabric, composed by all the trackers active in that website. The vertical length of this fabric indicates the number of trackers it contains. Each tracker, in turn, is identified with a number of threads proportional to the number of different types of data tracked by that tracker. This means that the 'density' of threads, the degree to which they are entangled, also allows for easy comparison between trackers. The design of this visualisation is quite deliberate: the curly/tortuous style of the threads is intended to give the images a sense of instability, signalling that the trackers and the collected data types may vary over time and over different browsing sessions. A dashed line indicates when no information is disclosed about what data a particular tracker collects. The icons to the left of the chart lines summarise the stated data retention policies of each tracker. For some trackers this is 18–24 months, for others it is a few years. More often than not, this remains undisclosed. Lastly, the icons on the right represent each tracker's 'data sharing' policy. It indicates what kind of data – for instance, aggregate data, anonymous data, and PII data – is shared with third parties.[21]

Comparing the 'tracker profile' of Kredito24.es (Spain, owned by Kreditech), Wonga (UK) and Spotloan's (USA, using technology licensed from ZestFinance (Hardy 2012)), we begin to be able to better detect important points of commonality and difference. Kredito24.es outweighs the other two in terms of the density of the data being tracked. All three are heavily reliant on trackers that do not disclose their data retention period.[22] They are also reliant on trackers that provide anonymous information about a particular user to third parties. For digital subprime lenders, what is important is the creation of specific profiles about their visitors in order to aid credit assessment. When combined with personalised data input by a potential borrower, this anonymous information can be tied to the individual. We can also see that Wonga is using a number of trackers whose data collection functions remain opaque – at least to *Ghostery*.



[Figure 5.4](#) Comparing Kredito24.es, Wonga and Spotloan

Further, the creation of individual profiles points us to what is unique in the tracking fabrics being composed by different digital subprime sites. In Wonga's case, a unique tracker is *QuBit OpenTag*. QuBit is a London based tech company, funded, perhaps coincidentally, by Balderton Capital, the same venture capitalist firm as Wonga. *OpenTag* itself is a tool partly designed to help companies improve their website's performance and monitoring. But QuBit also helps websites provide exactly the kind of real time personalised content, based on data such as browser type and IP address, that make Wonga's slider appear at different initial positions for different people. Thus, in a report designed to showcase the power of their analytics, QuBit describes how technology purchases by visitors using Safari are "around £30 more than any other browser", a conclusion designed to assist in practices of customer segmentation (Qubit, 2013: 14). Crucially this can be done virtually instantly, based on variables that many users might assume to be irrelevant.

Spotloan, meanwhile, is unique in using a tracker called *'ThreatMetrix'*. In an industry sales briefing, *ThreatMetrix* is described as a provider of integrated cybercrime prevention solutions. The *ThreatMetrix™ Cybercrime Defender Platform* helps companies protect customer data and secure transactions against fraud, malware, data breaches, as well as

man-in-the browser (MitB) and Trojan attacks (Threatmetrix, 2013: 2).

The tracker is significant because it shows how the industry of online tracking, often associated with understanding and shaping consumer practices, is in this instance linking up with an industry concerned with combating cybercrime. Establishing the identity of a borrower has long been central to credit assessment practices. As these practices move online, new opportunities for potential fraudsters open up, thus generating new challenges for creditors. Such trackers are an indication of tailored attempts to manage the emergent risks involved.

Conclusion

Our attempts to understand the algorithmic basis of digital subprime calculation are ongoing. Since this initial pilot project we have expanded our dataset to incorporate twenty sites we suspect of using similar techniques and are now collecting data on a monthly basis. We also aim to further engage with industry figures. We are thus still in the process of chipping away at the opacities that characterise this industry. Digital methods are tools to do so, but they will need to be combined with others. In order to understand the rise and significance of so called 'big data' analytics, we as researchers will thus likely have to rely on a diverse palette of approaches, not just to keep our objects stable and 'detectable' (Law, 2009), but also to be able to understand and to become attuned to their transformations as they pass through diverse of socio-technical registers.

Our initial research has, however, provided both insights into the tracking work being done by digital subprime trackers, as well as into the challenges facing researchers seeking to understand online algorithmic calculation from the outside of an industry. In respect of the former, we can return to Ossandon (2013), who suggests that, while we *know* that credit practices produce networks, "what kind of collective or social formation are we talking about? At what level do these networks operate?" In the case of digital subprime, our initial findings suggest the creation of networks not just between potential borrowers and organisations involved in the credit industry (including both lenders and third party credit reference agencies), but also now involving the ever growing industry of online tracking. These sites do, then, seem to have an interest in using trackers to collect user data for the purposes of credit assessment and online behavioural profiling and segmentation. Consumer credit lending has long been accompanied by a range of controversies (see: Deville, 2015). In the case of digital subprime, there is the potential for it to become wrapped up in the controversies surrounding the ethics of online tracking and the collection and retention of the data of users. Further, the deployment of 'custom' trackers and the common interest in particular data types also suggests an industry-specific 'professionalisation' of tracking practices. In other words, this is the highly emergent, likely experimental deployment of trackers that meet the specific needs of digital subprime websites.

Finally, we can reflect on what kinds of transparency such methods produce. Our findings are, to a degree, achievements of transparency, even if they remain incomplete. Striving to open up the opacities of digital subprime has also pointed us to the way in which digital methods itself is involved in the production of opacity. In our case, this has centred most clearly on our dependence on *Ghostery's* database and its process of categorisation. We have, however, departed from *Ghostery's* elementary understanding of trackers, and moved to a vocabulary of threads and density, which we consider more appealing to describe unseen 'work' of trackers (Star, 1991). Further, the role of rendering

visual what is usually unseen is also centrally important to our work. As Tyler Reigeluth (2014) notes, digital traces tend to be naturalised and claims can too readily be made about their objectivity. He proposes to see such traces as "in-formation" (Reigeluth, 2014: 253). For our emergent sociology of the invisible, the challenge has been, and continues to be, to grasp how trackers partake in forming digital traces and how they are also traces in formation themselves. One way we have begun to grapple with these issues is through visualisations that have emerged as the product of collaboration with designers. These reflections have helped us in turn to profile the different digital subprime websites, as different kinds and unstable textures. The challenge as we take this project forward is how to track and render visible these textures, as they continue to be re-shaped and knitted anew.

Acknowledgements

The authors would like to thank the editors and Paul Langley for their helpful comments on a previous draft of this chapter. Many thanks also to Frederica Bardelli and Carlo de Gaetano for their hard work on the visualisations and to Erik Borra and Emile den Tex for their assistance with the *Tracker Tracker* tool.

Notes

1 The way Star analyses 'social control' does not map cleanly into our case. Star is, amongst other things, concerned with the unseen, unrecognised and unpaid workers, such as (the many women) involved in unpaid (home) care. Their becoming invisible goes hand in hand with quite explicit forms of social control. Although the machines we study are indeed undertaking invisible work, their invisibility would connect up to very different forms of control – and would have less to do with their suppression as labouring subjects.

2 Although less relevant for present purposes, we are also interested and include under the 'digital subprime' umbrella another set of ventures that use alternative online methods to try to assess user behaviour (e.g., Lenddo and LendUp, both based in the US).

3 To be clear, these are individuals to whom the status 'subprime' is assigned by the credit industry, rather than a particular quality of personhood. Although the term is formally used within the industry to refer to borrowers who have fallen below a precise threshold in a risk-based analysis of creditworthiness, it is also used to refer more generally to those categories of borrowers that are perceived, irrespective of any formal evaluation, as undesirable from the point of view of mainstream lenders (see Langley, 2008: 473).

4 A site possibly using similar techniques is Sunny (www.sunny.co.uk). It is run by Think Finance, known for its use of big data analytics.

5 The 'mainstream'/'non-mainstream' distinction is a placeholder used for convenience. Payday lending is very much on a spectrum of credit products available to potential borrowers, and it would be incorrect to label it as in any way a separate domain. This is in particular given both the quantitative increase in such businesses in many countries, including the UK, and the fact that this industry relies extensively on ostensible 'mainstream' credit scoring technologies. It might better, therefore, be considered an example of what Rob Aitken (2006, 2010) calls 'fringe finance' (see also: Langley (2008: 170)), given that the metaphor evokes a continuity.

6 In the UK, an individual may have a number of such ratings, each generated by competing credit reference agencies. Wonga, for instance, draws data from both Callcredit and Experian (Wonga, 2014c).

7 At present it is unclear exactly what this additional third party data comprises (which is unsurprising, given that the information is proprietary). One source in a recent article in *The Guardian* newspaper speculates that Wonga draws on the wealth of free information that is available instantly online: electoral roll details, estimates of house values, for instance (Lewis, 2011). Wonga asks for users' vehicle registration details in the application process (if they own a vehicle). This might suggest they are tapping into the database of registered owners, perhaps to verify identity, perhaps to feed this into their risk calculations. Another source we spoke to speculated that they might also look into databases containing stolen mobile numbers (users are also asked to provide their mobile number), which could, again, be used to feed into their risk calculations.

8 Discussion with an anonymous industry source, 28 October 2013.

9 See, for instance, research into public views on targeted advertising (Pew Research Center, 2012), discussions about 'Do Not Track' (www.eff.org/issues/do-not-track), which dates from 2007, but also the writings by public intellectuals, such as Evgeny Morozov, about consumer surveillance (and about 'big data' in relation to credit assessments) (Morozov, 2013).

10 See for instance, Lightbeam (www.mozilla.org/en-US/lightbeam/) and Disconnect (https://disconnect.me/).

11 For example, through moving the nodes of your online 'data body' (Lightbeam), testing the effect of blocking trackers to your browsing experience such as connection speed (Disconnect), or by engaging with an analysis of rankings (*Ghostery*).

12 See: www.ghostery.com.

13 *Ghostery*. 'How It Works.' www.ghostery.com/how-it-works (accessed on 20 January 2014).

14 Evidon. 'Ghostery Sees What Scanners Alone Can't.' www.evidon.com/analytics (accessed on 8 March 2014).

15 See: http://knowyourelements.com (accessed 21 September 2014).

16 https://tools.digitalmethods.net/beta/trackerTracker/. The tool was created in a collaborative project by Yngvil Beyer, Erik Borra, Carolin Gerlitz, Anne Helmond, Koen Martens, Simeona Petkova, JC Plantin, Bernhard Rieder, Lonneke van der Velden, Esther Weltevrede at the Digital Methods Winter School 2012.

17 The *Tracker Tracker* found third party content on 72 per cent of the sites in the sample; using manual methods the figure was 73 per cent.

18 Project page: https://wiki.digitalmethods.net/Dmi/TrackersGuide.

19 See discussion here: https://twitter.com/Ghostery/status/433349897471799296.

20 For example, IP addresses could until recently only give an indication of geographical location and could not match the geodemographic precision of, say, a UK postcode (on which see Burrows and Gane (2006)), although this kind of research is progressing quickly (Lowenthal, 20 April 2011).

21 'Sharing PII data with third parties' does not necessarily mean that data is shared with any third party, such as the digital subprime website itself. It could also include another company that a tracker collaborates with, or an advertising network or broker.

22 Data retention period likely depends on the particular legislation in the country where the tracker company is based.

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Part III

Signal, visualise, calculate

6

Bodies of Information

Data, distance and decision-making at the limits of the war prison

Richard Nisa

Introduction: data, distance and decision-making

An April 2013 post on *The Stone,* the *New York Times'* philosophy blog, features an illustration by Brecht Vandenbrouke that creatively highlights the key spatial transformations that calculative devices introduce in the landscape of detainment (Figure 6.1). In the image, a mass of people gathers outside of a concertina-topped prison wall. In an opening in the wall stands a guard attempting to keep those bodies on the outside of the fence. However, just inside the fence stands a device resembling an enormous digital tablet, from which scores of prisoners emerge. They have, somehow, engaged with the device in such a way as to evade the guard, moving across this threshold from outside to inside not by way of the prison gate, but through screen of the device itself.

Vandenbrouke illustrates three interrelated transformations in the processing and circulation of data, the geographic distance between inside and outside, and the automation of decision-making that have emerged from the incorporation of networked devices into the landscape of wartime detainment. First, these newly detained individuals engage with and are processed by a digital device; that is to say, in moving across the threshold between inside and outside, the device reads their physical bodies as binary data in order to carry out a specific function. Second, the device simultaneously alters the distance between the inside and outside of the camp. In the image, the entry-point of the camp is dislocated from its material walls, and as such the ways in which bodies move or are moved across this threshold – how and where they are captured – is transformed. Finally, Vandenbrouke's guard is actually attempting to keep people out of the prison, but it is the device, not the guard, that ultimately makes the decision to detain.

As a reflection on the capacities of digital devices, like the one imagined by Vandenbrouke, to transform the landscape of detainment, in this chapter I

Figure 6.1 Hacktivists as Gadflies by Brecht Vandenbrouke

Source: Ludlow, 2013

describe the US military's use of digital biometric systems in contemporary war. These systems comprise technical devices that employ a combination of data infrastructures, modern statistics, and automated computational techniques to measure, store, and retrieve unique biological characteristics from a networked database. These characteristics range from fingerprints, iris patterns, and DNA to more recently calculable behavioural traits like gait, voice, and keystroke recognition. Their primary objective is identification, or what some military analysts have called "identity dominance," activities that link "an enemy combatant or similar national-security threat to … previously used identities and past activities" (Woodward, 2005: 30). What sets these practices apart from older 'analogue' biometrics systems is the fact that the biometric devices themselves must transform the human body into a 'template' composed of binary code that is machine readable and software sortable.[1] This searchable template is multimodal – in that it contains two or more different biometric characteristics – and also holds a diverse array of other data (including geo-locational information, biographical and interrogation reports), which can be called up in a single query.

Here, I engage with the ways in which these digital devices – like the Handheld

Interagency Identity Detection Equipment (HIIDE), and the Secure Electronic Enrolment Kit (SEEK) technologies – have modified the practice of detainee capture (Figures 6.2 and 6.3). Specifically, I outline how these devices have altered the space and time of the decision to detain, who makes that decision, from where, and towards whom it is directed, as these advanced (and rapidly advancing) calculative devices transform the decision-making spaces and practices of US military agents on the battlefield.

Apprehending global security

Figure 6.2 HIIDE enrolment device

Source: US Army photo by Sgt. Jennifer Cohen/Released

As the 1990s gave way to the new millennium, security practitioners focused their attention on emergent biopolitical threats thriving in spaces of global circulation and exchange. Security objectives began to target the potentially catastrophic risks that now careened "across social, technical, political, cultural and financial networks, straddling transnational scales" (Graham, 2012: 138). In what some call a global counterinsurgency, these threats—primarily international terrorism and terrorist finance, but also cybercrime, piracy, drug and human trafficking, and even highly mobile infectious diseases—have to be located and delimited, their disorder rechanneled into something productive for the state.[2]

Figure 6.3 SEEK enrolment device

Source: www.crossmatch.com/images/seek-bg.jpg

In counterinsurgency theory, one of the central (but also one of the most difficult) methods to counter these insurgencies is to isolate enemy bodies from the general population, so that they can be killed or captured. However, as enemy bodies are effectively indistinguishable from those of other human actors, traditional counterinsurgency tactics, such as containment and isolation, have proven time and again to be ill suited to these, mobile and stochastic, threats. In this landscape of unstructured menace, the security objective is no longer to capture and evacuate enemy bodies from the frontlines of the clearly defined battlefield, but increasingly to reveal an enemy lurking within fields of data, in order to act "upon indeterminate threats in the present" (Simon, 2012: 160). New technologies of rule perform not only the task of distinguishing 'friends' from 'enemies', but seek to extract the very existence of an enemy that has not yet become an enemy (Anderson, 2011a: 222) from a complex relational landscape. Counterinsurgency theorist John Nagl (2009) says, of this distance between the acts of war and the spaces of apprehension: "The hard part in a counterinsurgency campaign, isn't killing your enemy; it's finding your enemy".

Through this lens, security crises are not and cannot be totally avoided, and threats cannot be totally eliminated; they must be induced to appear in specific ways in order to enable the catastrophic prospects of the future to be tamed and managed (Aradau and van Munster, 2008: 24). Establishing optimal security conditions entails finding and articulating patterns of bodily affiliation – who has spent money in abnormal ways, who has moved

from region to region at suspicious times, how many men of military age have purchased one-way flights from a particular region – and using those patterns to predict how and where an insurgency might take shape (Anderson, 2011b: 211). These are practices that articulate differential risks, zones of higher risk and zones of lesser or lower risk (Foucault, 2007: 61). Individual tracking and surveillance – disciplinary practices built around a mode of visual control that is permanent in its effects even if it is discontinuous in action – are thus enhanced by mediated security practices such as data-mining, simulation, and electronic identification that target the population as a circulating mass (Foucault, 1979: 201).[3] Here the enemy must be induced to appear by way of relationships to other things: distant spaces, remnants of improvised explosive devices (IEDs), contacts with other suspicious individuals and monies, all of which are located beyond the spatial limits of any individual encounter (Amoore, 2013; de Goede, 2012). All bodies thus have an enlarged silhouette that requires the use of calculative technologies to reveal affiliations linking the black box of their physicality with their financial, communicational, and informational prostheses (Shapiro, 2007: 301).

One of the key spatial performances that emerges from this landscape of control is a distinct set of militarised detention practices, including new techniques of apprehension that do much to concretise the relational geographies of the so-called global counterinsurgency. These new practices create a form of control that is not bound to institutional enclosures; instead, it is geographically expansive and technologically varied. The US military is optimistic about the deployment of digitised biological data as an extension of this detention assemblage. Biometric systems are so central to 'making' the detainee that no fewer than six of the eight biometric systems in use in Iraq and Afghanistan were directly involved in detainee administration or detainee apprehension (Dee, 2007). Soldiers in the field have demonstrated that they know that

> leveraging the power of biometrics can be the difference between detaining, retaining, or releasing an insurgent and preventing an incident or picking up the pieces.
>
> *(Center for Army Lessons Learned, 2008: 108)*

The anxiety that surrounds the destructive potential of these encounters is not new. The point of capture has often been improvisational, disorderly, and violent. It was and often continues to be a place where

> most detainee abuse allegations occur … the point where emotions following enemy contact may run high and where … Leaders and Soldiers must monitor unit and individual stress to prevent violations of US military policy.
>
> *(Department of the Army, 2010: 4–8)*

At the biometric interface, however, capture is optimistically reimagined by way of engagement with a digital device that makes it possible to separate insurgents from the populace without moving anyone. This threshold is thus framed as a relatively banal organisational process: the technological sorting of certain actors from the fluid field of the population through biometric 'enrolment,' which industry literature claims can

> positively identify an encountered person and unveil terrorist or criminal activities regardless of paper documents,

disguises, or aliases.

(Center for Army Lessons Learned, 2011: 4)[4]

Flitting between data capture and bodily capture at the speed of available bandwidth, this kind of apprehension remaps the contours of wartime insecurity circumventing the problematic of friend or foe by transducing entire populations into a networked field of circulating, calculable, and relational data.

HIIDE and SEEK: capture at the speed of bandwidth

Digital biometric systems first appeared as part of US military operations in Kosovo in the early 2000s, where Biometrics Automated Toolsets (BATs) were used as a way of identifying local workers entering military compounds. The BAT system is composed of a laptop at a fixed workstation connected to a suite of peripheral devices that log digital fingerprints and facial information. Biometric templates enrolled into BAT are stored in local or 'on board' databases and uploaded to the Defense Department's Automated Biometric Identification System (ABIS) in West Virginia at a later time. Military use of the BAT system expanded in the early 2000s, and it was increasingly used to validate identities at a number of sensitive security sites and assist with the management of checkpoints and border crossings.

By the time the city of Fallujah was garrisoned in 2004, many were being fingerprinted and iris-scanned into BAT systems at the city's 'biometric gates'. The same was true when people sought entry to the Green Zone in Baghdad.[5] Enrolments like these were largely limited to fixed geographic locations, such as checkpoints and access points to government compounds, enclosing the city behind both physical and digital walls, and were not unlike those that were beginning to reproduce the US border at internal checkpoints, airports, and government buildings (Amoore, 2006). In 2007, upon taking over the command of US operations in Iraq, General David Petraeus – co-author of the newly revised *Counterinsurgency Field Manual FM 3-24* – ordered an increase in biometric scans to keep pace with the military's troop surge (Shankar, 2011). Petraeus' call for biometric expansion was aided by emergence of the Handheld Interagency Identity Detection Equipment (HIIDE) and the Secure Electronic Enrolment Kit (SEEK) in the spring of 2007. They provided an untethered, portable biometric collection and identification platform that led many, like Col. Natalie Jacaruso, a military deputy for the Biometrics Identity Management Agency's (BIMA), to view biometrics in Afghanistan as a game changer and a fully operational weapons system by 2011.[6]

To turn the bodies that make up a population into a weapons system relies on establishing an expansive array of interfaces for enrolment. With tools like HIIDE and SEEK, identity processing can occur anywhere, at any moment, for friend and foe alike. And this fusion of friend and enemy enrolment is key to the production of a landscape of control. Thus, while Iraqis, for instance, were "'added to the database when they [were] determined to be insurgents' or 'found near attack sites or detained', others have more recently been 'scanned at their homes, their workplaces, or at checkpoints'" (Frank, 2007). In areas of increased insecurity and violence, any men of military age (between the ages of 15 and 70) may be forced to submit to enrolment, a request backed up by soldiers' monopoly on the use of lethal force ("The Eyes Have It; Biometrics in Afghanistan", 2012).

While each device meets certain baseline criteria, their capabilities are constantly

expanding. The SEEK II, for instance, widely rumoured to be the handheld unit that the Navy SEALs used to verify the corpse of Osama bin Laden, combines multimodal enrolment capability with an e-passport and magnetic ID card reader. These additions extend the depth of the subject's data portfolio and draw more information into the relational database, increasing the number of connection points linking the body to a field of information. When the director of a major defence biometrics agency mapped out the technology's near future, he noted a number of desired enhancements that would do more than simply add more information to ABIS. By 2016, he speculated, defence biometrics would also be able to fix, read, and store a person's biometrics remotely (contactless capture), to reduce the amount of time that soldiers are involved in enrolment, and to speed up response times in order to more quickly render an automated decision about how to handle the enrolee (Boyd, 2013).

Counter to the above-noted attempts to enclose Fallujah, then, handheld enrolment puts military mobility in the service of security (Muller, 2011). Populations enrolled by handheld devices are not necessarily seeking entry to a place, as in Fallujah or at the US border; they might just meet a certain risk profile or live in an area occupied by security forces (Figure 6.4). It is not a matter of choosing to access culturally important spaces, security zones, or sites of labour and capital accumulation. Rather, enrolment becomes a highly mobile expression of military and state power meant to keep order, repress activity, and coordinate the flow of bodies. With the extensive use of handheld biometric devices, we are witnessing a generalised expansion in the distribution of interfaces of control, a multiplication of the number of spatial thresholds that exist as *almost already* military, as *almost already* detainment. Practices of security capture in the global war are distributed such that military detainment is, rather than an exceptional outside to logistical society, located on a continuum with it.

Figure 6.4 Handheld biometric enrolment in Afghanistan

Capturing calculated publics: a global apprehension assemblage

Biometric enrolment, then, subjects bodies to a particular form of state visibility. But this visibility is not really a question of seeing. Rather, it is the instance, the algorithmic trace, the particular formulae that the state uses to parse out important information from the noise.[7]

> Nobody would try to judge the creditworthiness of a credit card by looking at it, in the way one would peruse a banknote…Visual identification is now out of the game. In this instance, exactly transmissible but invisible algorithms have already replaced all visual and physical traces of authenticity.
>
> *(Mario Carpo, 2011: 3, 4)*

Through the use of biometric devices, this automated and algorithmic process transforms the wartime encounter between the combatant and the population, reconfiguring what was once called the most vulnerable period of detainee operations (US Joint Chiefs of Staff, 2008: V-2) as a practice governed increasingly by the "bloodless sciences of risk management and actuarial assessment" (Margulies, 2011: 746). The resulting set of decisions – to detain, to track, to deny entry, or to let pass – is based on predictions of group behaviour like pattern of life analyses and predictive analytics, semi-automated data harvesting technologies that seek to anticipate and map emerging global threats.

When a database query yields a 'hit', the enrolment device alerts the soldier-operator to the enrolee's risk score. These risk profiles turn all banal encounters between civilians and the military (and its state security proxies) into potential sites of bodily apprehension. The risk score presents the warfighter in the field with a clear series of potential decisions, underwritten by the authority of the database and its code. Presented with a series of possible actions, the combatant is faced not with an either/or fleeting choice between kill or capture, but with a pre-established set of risky tiers which run a gamut from detention to mere job disqualification (Table 6.1). The decision to detain (or not) is not determined solely by situational awareness or by an understanding of immediate threat or danger, but made through an algorithmic interpretation of potential future riskiness as presented to the captor by a technical device.

By 2012, the digital biometrics regime had facilitated the apprehension of over 3,000 enemy combatants in Afghanistan and almost 900 "high value individuals worldwide" (Government Accountability Office, 2012: 16). As a result of the more than 175,000 fingerprints taken outside of spaces of detainment and added to a rapidly expanding digital database, an additional 2,300 people have been denied early release from military detainment, and 80,000 persons have been placed on 'do not hire' lists.[8]

Table 6.1 NGIC Iraq and Afghanistan watch list totals: 8 August 2008–3 September 2008

Watch list tier	*Action*	*Quantity*

Tier 1	Detain if encountered	1,929
Tier 2	Detain for questioning	108
Tier 3	Collect and enrol, US Government	0
Tier 4	Do not hire/deny base access/disqualify for training	16,213
Tier 5	Deny base access	5,997
Tier 6	Track movement	14
Watch list total		24,241

Source: Hunt, 2008

This type of decision-making assemblage enabled by a suite of algorithms, procedures, actors and technical devices has implications for how the military makes the particular subject class 'enemy' legible. For instance, when queried, an algorithm might organise data to reveal new groups of affinity based on a host of relational data points, such as shopping habits or travel times. Tarleton Gillespie calls these communities "calculated publics" – social organisations that "may overlap with, be an inexact approximation of, or have nothing whatsoever to do with the publics" that individuals themselves can understand (2014: 189).

When the lived world has been transduced and rendered into a standardised, replicable string of code (Kitchin and Dodge, 2011), this resultant data becomes incredibly mobile and pliable, while a person's identity gets fixed to a single biologically determined reality.[9] Fluidity, once a key aspect of the discourse on the performativity of identity (Butler, 2006), is now associated with the iterative nature of the relational database. Identity, to the biometric assemblage, is finite, fixable, and for the enrolled body, inescapable. But the data that underpins a subject's digital identity is constantly expanding, broadening, and shifting, giving rise to a "relational ontology" that can understand biometric data as part of a series of "regular, uniform, and only loosely connected objects that can be ordered in a potentially unlimited number of ways at the time of retrieval" (Gillespie, 2014: 171). If the keywords or practices underpinning the status category 'enemy' change, if the limits of a particular calculated public are redefined, a modification of the search algorithms can reveal a new enemy population lurking in the fields of data: a newly exposed calculated public whose members may not even be aware of others with whom it share its affiliations. Through these processes of enrolment and data acquisition, the bodies of potential 'friend' and potential 'enemy' alike are entered into a database that is indifferent to their present status as either.[10] One's status as friend or enemy is determined through querying that database, calculating how the material body fits into a dynamic field of information.

When a person is biometrically enrolled, their data is encoded and run through 'on board' databases for matches, including queries of biometrically enabled watch lists (BEWLs). As of April of 2012, the main watch list in Afghanistan contained the names and bodily information on over 33,000 Afghans.[11] These ever-changing watch lists are

collections of biometric templates that analysts have determined represent not only existing enemies, but persons who represent threats, potential threats, or who simply merit tracking; they also seek to preemptively engage with future ones (Center for Army Lessons Learned, 2011: 8). Regardless of whether the enrolee comes up on the on-board BEWL, all data is eventually sent to BIMA headquarters in Clarksburg, West Virginia, to be processed, analysed, and stored. In Clarksburg, the information captured flows through another series of algorithms to determine if it resonates with existing records or latent (or unknown) prints pulled from objects in the field.[12] If a match is made in ABIS, the data is forwarded on to the National Ground Intelligence Center (NGIC) in Charlottesville, Virginia (Center for Army Lessons Learned, 2011: 10, 39), and the enrolee is informed how to proceed.

However, the algorithmic production of calculated publics is not solely an abstract, technical achievement; it is thus still important to unpack the warm human and institutional choices that lie behind these cold mechanisms (Gillespie, 2014: 169). In West Virginia, Certified Latent Print Examiners (CLPE) compare templates with a growing archive of digitised latent fingerprints gleaned from Iraq and Afghanistan – many of them from the fragments of IED events (Biometrics Identity Management Agency, 2011). These distant examiner-agents exist as a sort of bureaucratic mirror to the drone pilot's distant violence, an extension and geographic distribution of the soldier's body. But rather than deploying lethal force from an Air Force Base in Nevada, as a drone pilot does, the latent print examiners calculate a risk score, which is then returned to the field; it is this score that articulates the captor's proper course of action. These analysts see themselves as a direct part of the extensive battlespace:

> "Our examiners are protecting the warfighter," said CPLE Allison Miller in a BIMA promotional video, "and I think that is one of the most exciting things about what we do".
>
> *(Biometrics Identity Management Agency, 2012)*

Indeed, they are an integral part of this digitised iteration of late modern war. For over sixty years, the decision to capture was made on the spot and on the battlefield by soldiers who often flouted both official regulation and the *III Geneva Convention relative to the Treatment of Prisoners of War* in international conflict. When digital biometrics were first deployed in theatre, this same decision took anywhere from 22 minutes to 15 days, and was enabled by analysts in the heart of the American coal country. The most recent devices – like those piloted in the Army's Last Tactical Mile program – aim to move biometric capacities beyond static operations and out into the kinetic landscape of tactical operations, which ultimately requires reducing the amount of time necessary between enrolment and generating an accurate match in the database (Figure 6.5). After expanding the 'capture chain' to up to 15 days, then, the Army is doing its best to reduce the time-to-match to below two minutes.

Derek Gregory has outlined the many ways in which the drone assemblage works to shorten the 'kill-chain' of aerial bombardment, reducing the amount of time between the location of a target and its destruction (Gregory, 2011). In an inversion of this space-time

compression, the biometric encounter's utilisation of distant spaces of decision-making lengthens, mediates, and distributes the geographic footprint of the 'capture chain'. Here, the space between capture and the camp is charted by groups of geographically distributed people operating on multiple technological interfaces: warfighters and agents with enrolment devices in the field; analysts, algorithms, and computer processors in West Virginia, others in Northern Virginia.

As biometric enrolment has become more common in late modern war (Gregory, 2011) and the information it procures wirelessly distributed to civilian and military databases, the military increasingly acts as if identity is something fixed and inseparably linked to a series of relational effects – group affiliations, family histories, travel itineraries, banking records – of which the physical body is just one manifestation. The acts of classification and transduction performed at and through these interfaces turn the individual body into a witness against itself—establishing connections between an enrolee's particular identity, reducible to their physical body, and their expanded relational data shadow (van der Ploeg, 1999: 301).

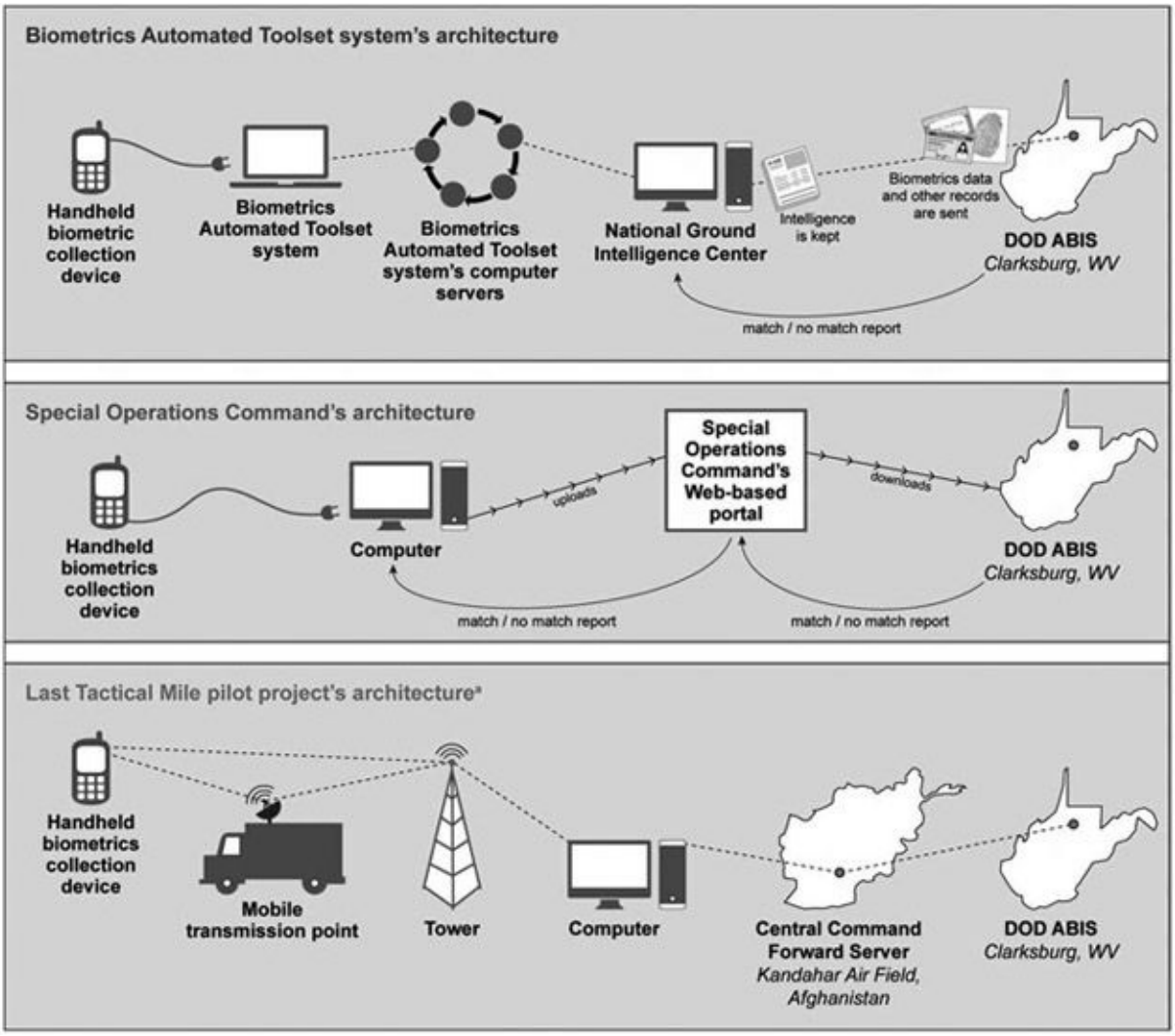

Figure 6.5 Distributed decision-making; three biometrics system architectures

Source: Government Accountability Office, 2012

The capturing soldier thus has an obligation to apprehend and circulate accurate

evidence of the encounter. If troops fail to properly administer biometric enrolment, a 'high value' individual might not be apprehended, or, as cited above, it could be the difference between detaining, retaining, or releasing an insurgent and preventing an incident or picking up the pieces (Center for Army Lessons Learned, 2008: 108). The entire assemblage hinges on the importation of consistent, standardised information to function. Major Frank Sanchez of the US Marine Corps notes the importance that maintaining these databases plays in facilitating battlefield management, stating that "[b]iometrics is no good unless you have that database to bounce it off of" (Biometrics Identity Management Agency, 2012). Despite these high stakes, military commanders are consistently frustrated by the delay between enrolment and uploading data into the system.

The goal of uploading all enrolments within eight hours of an operation's completion is often not met. Sometimes these uploads are still incomplete up to five weeks later, leading to incomplete or out-dated BEWLs in the field (Center for Army Lessons Learned, 2011: 15).

Additionally, the increased numbers of enrolments and queries (growing between 15 per cent and 40 per cent annually over the last several years) has added pressure on the Defense Department's ABIS database.[13] This has revealed the limitations of the original ABIS, and since 2010, four attempts have been made to upgrade the system to handle the expanded workload, meet emergent data standards, and improve data interoperability. But as of August 2013, all four of these attempts had failed. Each failure resulted in a rollback to the initial database architecture, as the upgrade attempts

> disabled critical interfaces with ABIS customers, preventing high-priority customers from receiving timely, accurate match results while maintaining compliance with established sharing agreements.
>
> *(Department of Defense Office of the Director, Operational Test and Evaluation, 2014: 16)*

As part of a security apparatus that no longer seeks to prevent, to order or to withhold, but instead to pre-empt, to allow to play out, to make probabilistic judgment, these technical limitations constrain the speculative capacities of biometric governance (Amoore and de Goede, 2008: 10).As Greg Elmer andAndy Opel (2006: 477) have noted, "'[t]he ability to accurately answer "what if" questions,'that is, to calculate the landscapes of possibility in the hope of revealing unknown or future enemies, 'relies upon the stability of data – the more unstable, abstract, and variable the data the less likely one can predict the future'".

Despite these limitations, the digital biometric assemblage has emerged as a key hinge around which the governance of the potential nondescript catastrophe looming in the future becomes possible (Braun, 2007: 18). Enrolment sets in motion a host of potential activities across a broad array of spaces and technologies. It can result in a detention; it can result in no further action at all; or it can call for this specific body to be tracked, followed and pursued by overhead surveillance drones that, at a later time, might deploy a sudden lethal blow from the sky. These encounters, in homes, compounds and villages – but also at airports and security checkpoints – are meant to remind the occupied subject at all times of

their position not as a person, but as an object of information, a target of governance and a potential target for lethal force.

Conclusion

> We don't build the system or the data collection device. We build the vision.
>
> *(Giovanni Demonte, Chief of Architecture and Standards Branches, Biometrics Identity Management Agency, 2011: 12)*

Wartime detention has become an increasingly central part of the global data landscape, and this global data landscape, in return, is equally central to the constitution of the war prison. Whereas soldiers would historically capture bodies to gain control of the battlefield and garner timely tactical information, now, the generation of copious amounts of information via distributed technologies brings into view a public from which the detainable body is calculated. Finding and apprehending the wartime prisoner is thus a question of global communications infrastructures, data-gathering, and information (not just for troops, but for an expanding population of administrators and remote databases as well).

With enrolment via handheld digital biometrics devices, the architectural and disciplinary clarity of detainment space has been further removed from geographically fixed space and the horizons of the visual, and moved towards the digitised iterations of the microscopic and genetic data that we all made from. Though practically imperceptible, these biometric traces that mark the limits of detention erupt from our corporeal mass only to be catalogued and organised, then disappear. Here, the capacity of the prison wall as a spatial organiser is complicated by a performative, invisible, and networked interface. As illustrated by the image that began this chapter, hand-held systems present users with an interface *through* which (rather than over, under, or beyond) people and places are seen, understood, and governed. Calculative devices alter the process of battlefield capture by serving as a beginning and an end to a digitally networked capture chain that draws together a suite of geographically distributed actors, agencies, and relational databases in order to present the battlefield decision-maker with a statistically and forensically calculated set of options.

Notes

1 There are of course many vectors that connect analogue and digital biometric systems. Analog biometric regimes, for instance, began as a tool of the British Empire at its colonial limits only to be introduced later into Western institutions and state practices in particular, typically less repressive ways. Sengoopta, for instance, shows that while the routine fingerprinting of entire civilian populations (as opposed to only convicted criminals) would have been unthinkable at the time in the British metropole, "[t]he body of the colonial subject…was another matter altogether" (Sengoopta, 2004: 203). Later, these practices would 'boomerang' back into the metropole in a highly controlled way as a form of criminal identification and state management. The same is true of digital biometrics (Foucault, 2003; Graham, 2011: XVI). The debate over the New York Police Department's keeping of digital biometric records of prison populations highlights the tensions that emerge when the boomerang spins back (see Rivera and Baker (2010)).

2 On global counterinsurgency, see: Kilcullen (2005); Mitchell et al. (2010); Roper (2008). On the landscape of threats as understood by security professionals, see the "threat umbrella" outlined in Jones (2013).

3 Foucault and his interlocutors maintain that disciplinary power does not disappear in situations where security power is evident, but rather that the security framework is positioned relative to a different set of problems, "occluding those of disciplinary governing at specific moments, in particular places" (Amoore, 2011: 36). See also: Burchell and Miller (1991); Dean (1999); and Foucault (2003).

4 For a critique of biometric power, see Magnet's outstanding study (2011).

5 The biometric gates of Baghdad and Fallujah in many ways emulate the Strategic Hamlet Program's spatial partitioning of populations in the Vietnamese countryside (see Belcher, this volume).

6 BIMA (Biometrics Identity Management Agency, 2012) was formerly known as the Biometric Task Force (BTF) until 2010, when it was changed to the Biometrics Identity Management Agency (BIMA). In mid-2013, BIMA was again rebranded as the Defense Forensics and Biometric Agency (DFBA) and formalised as a field operating agency under the Army's Office of the Provost Marshal General. This was done so that digital biometrics would remain a structured part of the Department of Defense after the withdrawal of ground troops from current operations. However, the acronym BIMA remains in use when referring to the component that operates and maintains databases in Clarksburg, West Virginia.

7 Or, as Ansorge asks, "What is seeing like a state when the state sees through databases?" (Ansorge, 2011: 73).

8 (Boyd, 2013). In 2012, BIMA claimed that there were more than 4,400,000 unique identities in the ABIS database and over 7,000,000 total records (Biometrics Identity Management Agency, 2012).

9 Shoshana Amielle Magnet (2011), in her important work on the failures of biometric systems, has problematised this and highlighted the ways in which it is linked to modes of scientific analysis built on troublingly static and flawed understandings of race, gender, and identity more broadly.

10 In fact, just as the database does not distinguish between enemy and friend (it simply holds data), the biometric scanner does not necessarily differentiate between life and death. While usable data can still be harvested up to six hours after a body is pronounced dead ("The Eyes Have It; Biometrics in Afghanistan", 2012), in the face of potentially fraudulent uses of biometrics acquired from deceased, dismembered, or fake bodies, the biometrics industry has directed considerable attention to so-called 'liveness detection,' or the technological capacity to recognise when the

scanner is reading a living source (Drahansky, 2011).

11 (Government Accountability Office, 2012: 8). These onboard watch-lists are subsets of much larger lists maintained by BIMA in West Virginia and the National Ground Intelligence Center in Virginia. In late 2013, there were over 175,000 entries on ABIS's BEWLs (John Boyd, Director, Defense Biometrics and Forensics, 2013).

12 Clarksburg, West Virginia has emerged as the biometrics and forensics capital of the US. Myriad databases are housed here, including the FBI's Integrated Automated Fingerprint Identification System (IAFIS), the Department of Homeland Security Office of Biometric Identity Management's (OBIM – formerly US-VISIT) Automated Biometric Identification System (IDENT), as well asABIS, the Defense Department's Automated Biometric Identification System. These three systems are not integrated – or *interoperable* in security parlance – and while there has been a push by some to combine them, one of the key reasons for keeping them distinct is because the privacy and civil liberties concerns are different for foreign and domestic populations. See endnote 1.

13 Personal email correspondence with Communications and Outreach Branch of the Biometrics Identity Management Agency, 14 October 2011.

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7

Data Anxieties

Objectivity and difference in early Vietnam War computing

Oliver Belcher

> The closer one comes to the "sharp end", to the point where the data really originates, the more difficult the task it seems to be to put things into a manageable form.
>
> *(ARPA Data Base Project Report, n.d.: 5)*

> Vietnam was an unusually statisticized war, precisely because everyone was groping for understanding.
>
> *(Thomas Thayer, 1975a: 771)*

Introduction

In January 1967, an ambitious automated data collection system was launched to measure the status of the United States pacification campaign in the villages and hamlets of South Vietnam. The automated system, known as the Hamlet Evaluation System (HES), marked one of the earliest attempts by the US military to utilize nascent computer-based technologies in mapping and computational statistics to geographically survey, catalogue, and calculate population patterns (and later trends) in a war zone. The HES was designed to track a broad range of security and development factors in over 12,500 hamlets spread across 44 provinces in South Vietnam, from enemy activity and local police presence to food distribution and education. Coming five years after an escalation in US involvement in South Vietnam, the HES was the latest attempt in a long series of efforts by the Saigon-based US Military Assistance Command, Vietnam (MACV) to systematically report and measure geographic and population control ("pacification") in the Vietnamese countryside. While other systems proved to be either limited in their intelligence capacity or outright failures, the promise of the HES rested on its ability to store information on hamlet location, population size and activity, thus allowing US military and Government of Vietnam to orientate military forces and "Civic Action" teams around key hamlets contested by the Viet Cong (Ewell and Hunt, 1995). What made the HES an indispensable intelligence source was it served as the only record in South Vietnam where the population was located (Thayer, 1985: 41). The fascination with the minutiae of hamlet activity was only half the story, however, as the real innovation of the system lay in its ability to make high-resolution computer-generated maps featuring *every hamlet*[1] in South Vietnam. These maps were state-of-the-art, and facilitated the emergence of a new visual register. These visualisations allowed monthly 'progress' to be viewed through the production of color-coded maps indicating the degrees of Government of Vietnam or Viet Cong control within every hamlet in South Vietnam (Figure 7.1). With its comprehensive statistical outputs and ability to produce 'more objective' maps, what the US military and its civilian counterparts hoped to accomplish with the HES was a practical grid of reference that could make South Vietnamese society 'legible', in its finest details, all the way down to the level of the hamlet.

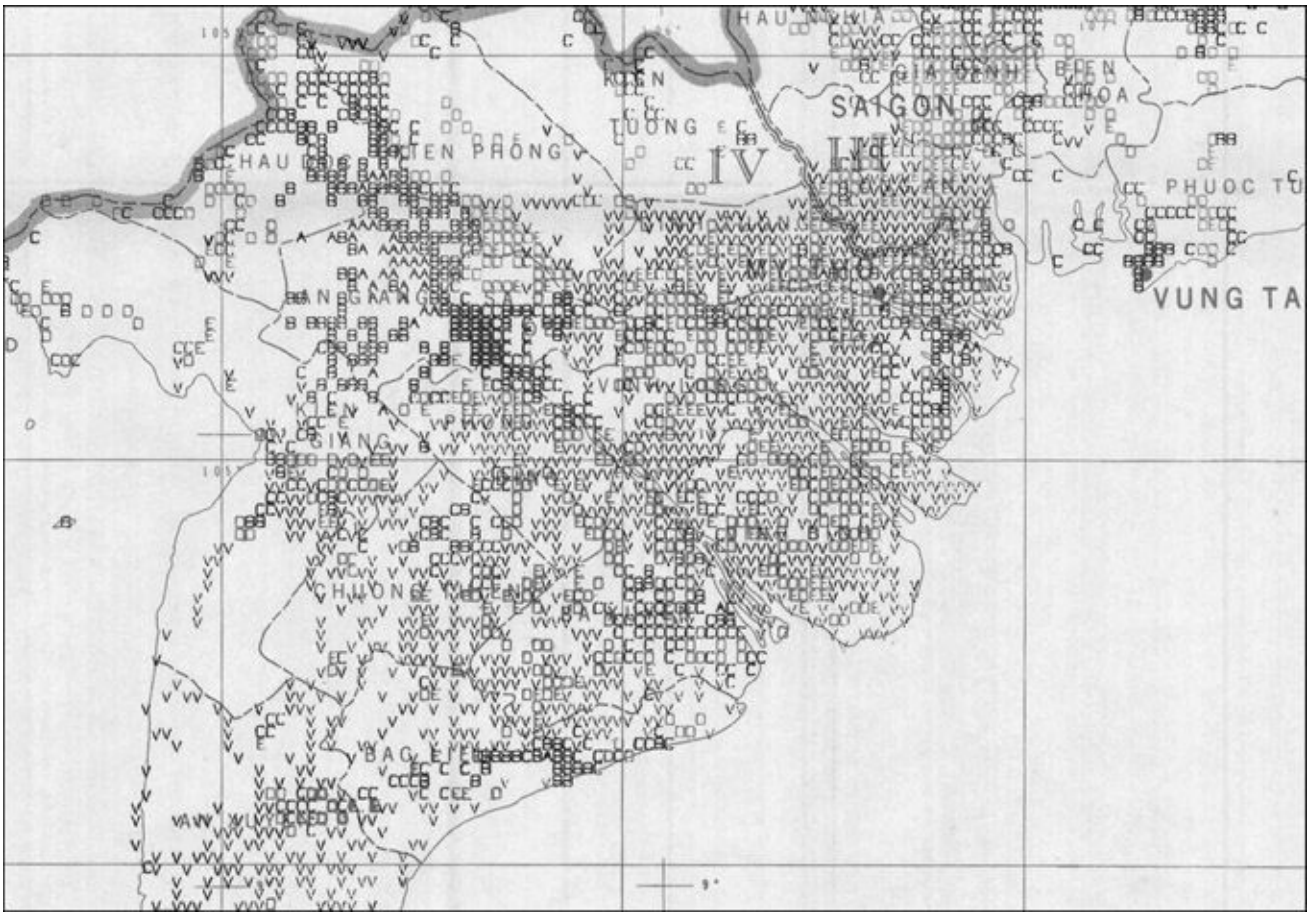

Figure 7.1 HES map indicating the "control" status of hamlets in the Mekong Valley, May 1968

Source: Lyndon B. Johnson Presidential Library

In this chapter, I argue that the introduction of computation, and particularly the development of information systems like the HES, transformed how Vietnam was understood by military personnel. Although a full account of the HES cannot be given here, I briefly outline how the program was developed and put into operation. A central effect of the HES was the displacement of a once privileged 'subjective judgment' of seasoned commanders and military personnel with a 'computationally-based' view within the US military at all levels. As the computer assumed a central position in US military operations in Vietnam, I go on to discuss two 'data anxieties' that emerged when the HES was inaugurated. The first 'data anxiety' lies at the point of data-capture by US military advisers observing hamlet activity and working through Vietnamese counterparts – an anxiety largely drawn along racial lines of who gathered the data, an American or Vietnamese adviser. Despite the 'more objective' pretensions commonly assumed whenever computers replace human handlers of data, what is clear is that data input and output never turn out to be as value-neutral as the aura of the computer seemed to give; in fact, the materials gathered to make the Saigon-based computers useful was always marked by "incalculable difference" (Amoore, 2014). The second 'data anxiety' I examine is the status of cartography once computer-generated maps were capable of being produced. I analyse the implications of mapping when the 'objectivity' of the shaky-handed manual cartographer, who was apparently only capable of making 'area' maps, was thrown into

doubt by the ‘precise’ high- resolution hamlet map spat out at the end of the printer. The marriage of military intelligence systems, such as the HES, with computation raised the spirits for an analytical approach to war, one capable of making the Vietnamese countryside ‘transparent’ to the trained observer. Or so it seemed.

Data deluge

In her book *'Along the Archival Grain'* (2009: 1), Ann Laura Stoler reminds us that "colonial administrations were prolific producers of social categories." This sentiment can certainly be extended to the plethora of US and civilian agencies operating in Vietnam throughout the 1960s and 1970s, where oft-times cavalier and contradictory depictions of Vietnamese society were circulated within policy documents, journalistic accounts, and popular media. Yet, as the operationalisation of the HES shows, the hallmark of US knowledge production in Vietnam did not merely reside in the fabrication of beguiling social categories. Rather, computational reporting and mapping systems like the HES underscored how the American military privileged the technical enactment of numerical data to gain meaningful insight and understanding of Vietnamese peasants and lifeways.

The resort to quantification has a long history within US imperial exploits, including up to the present day with the US military's abuse of social scientific methods (e.g., social network analysis) and geospatial intelligence to map the so-called "human terrain" of Iraq, Afghanistan, Pakistan, Oaxaca and elsewhere (Belcher, 2014; Wainwright, 2012). For historians such as Alfred McCoy, the hubris of quantification is the very signature of American orientalism – what he calls its "inherently superficial character" (McCoy, 2009: 44) – given the US military's penchant for data accumulation (for historical background, see Farish, 2010: 51–99). "If the Europeans prized erudition," McCoy notes (2009: 44) in a contrast he draws between European and American forms of orientalism,

> the Americans preferred information [in early twentieth-century Philippines], accessible and succinct. If European imperialists emphasized deep cultural knowledge of oriental societies, American colonials amassed contemporary data for control from without.

The war in Vietnam was no different, as the US military was awash with data and information.

With Robert McNamara at the helm of the Department of Defense, and his famous affection for data-driven "systems analysis" that radically changed the institutional culture of the Pentagon throughout the 1960s (Kinnard, 1977; Light, 2005), the apparently 'pragmatic' fascination with quantification reached unparalleled heights during the Vietnam War. The enchantment with numbers was only exacerbated after MACV's installation of the IBM Systems/360 model computer, the most advanced computer of its time, at its new Saigon headquarters in 1967 (Cosmas, 2006; Feltham, 2012; cf. Campbell-Kelly et al., 2014). The Systems/360 was operated by the newly formed MACV Data Management Agency, who handled HES data, and centralised automation and database management within MACV, thus allowing faster turn-around times in data processing and analysis. However, the fondness for 'concrete' statistics quickly faded as the information produced became unmanageable. The computerised data-crunching systems quickly turned into a binge of printed 'intelligence', resulting at one point in the MACV document

exploitation center printing upwards of 1,400 pounds of reports *per day* (Cosmos, 2006: 292).[2] In all likelihood, it was this kind of excess that led conservative military historians like Martin Van Creveld (1985: 241) to conclude that it was "information pathologies that characterized the war in Vietnam and made no small contribution to its outcome." Indeed, despite the reams and reams of statistical reports printed, each page packed with various up-to-date indices of 'progress', the HES never lived up to its promise for a variety of reasons, not least of which were the system's limitations in its central purpose of *effectively* evaluating pacification progress in the countryside.

Accounts differ as to why the HES proved in the end to be so limited, considering the large dedicated staff to the system during its eight years of operation (1967–1974). In any given month, 244 US military advisers and their Vietnamese counterparts gathered data from the hamlets in their assigned districts. The field data was sent to MACV headquarters where, at any given moment, a staff of one to two hundred processed and analysed it. For its advocates, the accuracy of the reports produced by HES was for the most part sound, but ultimately resulted in an overload of information, which could never be utilised to its full analytical potential (Allen, 1991: 224; cf. Thompson and Frizzell, 1977: 192). As Gregory Daddis (2011: 47–49) claims in his comprehensive study of the various reporting systems in Vietnam, data reporting systems, such as the HES and others like it (e.g., the Territorial Forces Evaluation System, and the Terrorist Incident Reporting System), privileged data accumulation over analysis, with data collection largely becoming an end unto itself. Daddis suggests that the reliance on statistics was a substitute for a lack of a coherent strategy to face an insurgency, leading to a quixotic search for a "practical index" by which to gauge "progress". For the CIA analyst George Allen, the chief architect of the HES, "one of the mistakes people made with the Hamlet Evaluation System was to try to take everything as religiously accurate" (quoted in Rehm 1985: 5/17). Despite the dubious accuracy of the numbers, the HES output was often exploited and misrepresented for political purposes by the Johnson Administration to sell 'progress' to a war-weary American public.[3]

The abuse of military statistics for political purposes (most notably the "body count", but also the HES; cf. Tyner, 2009) gave rise to prominent critics of quantification during the Vietnam War (Adams, 1994). For critics of the HES problems began at the very site of data collection (e.g., Tunney, 1968). From the outset, HES was plagued with reliability problems stemming from its methodological design; i.e., the data-gathering point of the US district adviser who reported monthly on the status of hamlets in his district. The limitations of language fluency and subjective judgments gave rise to questions over the quality of the data itself, a 'data anxiety' I discuss below.

To be sure, the criticisms leveled at the Hamlet Evaluation System are sound and largely accurate. But, they only address what Ian Hacking (1982) once called the "overt" ramification of statistical studies of populations such as that carried out by the Hamlet

Evaluation System; that is, the "gigantic quantities of data [amassed] that are seldom effective in controlling or altering the populations of study in the ways intended" (Hacking, 1982: 280). If the numbers produced by HES neither matched up with world as intended, nor oriented military and civic actions in such a way that they gained effective control over the population, nor helped in 'winning' the war, such is the hubris of militarised quantification. Yet, as Hacking argues unintended "subversive" effects linger, insofar as statistical enumeration "demands *kinds* of things or people [to] count" (1982: 280; original emphasis). In the case of the US war in Vietnam, the subversive *effects* were not only a matter of determining how particular kinds of things count (although that was important, especially in the case of mapping hamlets discussed below), but perhaps more importantly, how seemingly 'neutral' *calculative devices* were utilised to do the counting in the first place. The subversive quality of these calculative devices, such as the computer, had profound implications on what constituted 'subjective' or 'objective' judgment, 'objective' representation in manual or computational mapping, as well as what counted as 'good' or 'bad' data. I call these subversive effects that emerged with the introduction of computation in Vietnam 'data anxieties'.

The Hamlet Evaluation System

How did such a large and ambitious system such as the HES work? As already noted above, the HES was the latest in a long line of data reporting systems seeking to measure pacification progress in the countryside. Earlier reporting systems were largely run by the Government of Vietnam in coordination with the Central Intelligence Agency to measure the status of security in hamlets in Ngo Dihn Diem's "strategic hamlet program" (for background, see Catton, 1999).

Reporting for the strategic hamlet program (1961–1963) was "numbers-oriented", but the techniques for measuring hamlet security were conducted manually through summary tabulations of "gross numbers of strategic hamlets under way and the status of each, kinds of fortifications completed, and numbers of peasants brought under 'control' within the hamlets" (Legere, 1971: 7).[4] After the 1963 coup, which resulted in a dramatic increase in US military engagement, a premium was placed on reliable military intelligence. From 1965 to 1967, this largely took the form of a conventional 'body count' (enemy killed, weapons captured, area gained), although rudimentary and manually produced reporting systems (such as the MACV Monthly Report on Revolutionary Development) were put into operation.[5] Despite the ability of US forces to overpower North Vietnamese and Viet Cong units, the war in South Vietnam never turned the corner towards 'winning' as claimed by proponents of the 'body count'. As Daddis (2011) has convincingly shown, the 'body count' was symptomatic of a misunderstanding by military commanders of the kind of war they were fighting. As the limits of the conventional military approach became apparent both within and outside of the military apparatus, policymakers in Washington and Saigon, most notably Walt Rostow, yearned for an index by which security and population support could be measured in the countryside (Palmer, 1984: 49). Moreover, after the 1963 coup and assassination of Ngo Dihn Diem, intelligence information supplied by Vietnamese sources was met with skepticism.

In October 1966, Robert McNamara asked the CIA to develop a reporting system based on a village level system the US Marines had developed to measure security indicators in villages along the border with North Vietnam. The CIA sent a team headed by the leading Vietnam intelligence analyst within the agency, George Allen, to Saigon to develop a "matrix" by which the new Hamlet Evaluation System could measure hamlet control with "as much objective precision as possible" (Allen, 2001: 220). The result was a punch-card processing reporting system, where every hamlet in South Vietnam was evaluated on eighteen indicators grouped under six factors, with three indicators in each factor. The central ingredient to the system was the Hamlet Evaluation Worksheet, where each indicator was graded from E (= worst) to A (= best) by a US military district adviser (Brigham, 1968: 4–5).

Three of the factors measured on the original security concerns (VC Military Activities;

VC Political and Subversive Activities; Friendly Security Capabilities), while the other three measured development activities (Administrative and Political Activities; Health, Education and Welfare; Economic Development). For example, for the indicator "Activities Affecting development" under "VC Political and Subversive Activities", the following grades would be chosen by the US district advisor:

- E = VC apparatus can undermine GVN in hamlet by incidents ranging from propaganda thru terrorism and sabotage, at least at night.
- D = No overt propaganda but terrorism or sabotage during past month.
- C = No overt VC incidents in hamlet, few signs of covert subversion.
- B = No subversion in hamlet and no incidents in adjacent hamlets during month.
- A = No subversive activity in village during month.

After district advisers assigned a grade for all eighteen indicators on the hamlet evaluation worksheet, they proceeded to fill out a monthly Hamlet Evaluation Summary form for all the hamlets in their district that were sent on to MACV headquarters in Saigon. Thousands of data-cards were punched each month and fed into a computer for storage and processing. For storage purposes, every hamlet was assigned a Government of Vietnam serial number, a MACV identification number, Universal Transverse-Mercator coordinates, population size, monthly evaluation ratings and changes, a confidence index on data reporting, and coded responses to particular hamlet problems. Military analysts at MACV headquarters then applied a simple Baysian statistical algorithm to the monthly input and calculated scores (0 = worst, 5 = best) to determine an overall evaluation score for each hamlet, village (an agglomeration of hamlets according to the system), district, and province, providing a monthly total "situational" report for the country. The 'truth effect', so to speak, of the system revolved around the ruse of 'objectively' rating and evaluating the political control or instability within individual Vietnamese hamlets, despite the fact that the data input was based on the *subjective* interpretations of US district advisers. By the 20th of every month, updated monthly reports were distributed back to provincial and district advisors, who would then (ideally) recalibrate forces within their districts based on the report output.

Data anxiety 1: Other sources

One of the central claims advanced in this volume is that the technical armatures used to gather data or monitor populations are themselves implicated in the very ways in which populations or entities are made intelligible to the states and organisations that employ them (Amoore, 2013; Rupert, Law and Savage, 2013; Meehan, Shaw and Marston, 2013). Take, for example, the notion of achieving "greater objectivity" in understanding the

Vietnamese population, a key motivator behind the development of the Hamlet Evaluation System (Clark and Wyman, 1967). As Daston and Galison (2007) have shown, "objectivity" is not a transcendental ideal or spirit realised in scientific experiment, but rather an "epistemic virtue" *achieved* through the material arrangements and kinds of instruments one has on hand. In the nineteenth century, philosophers and scientists throughout Europe and the United States found themselves engaging with new inventions such as photography or the illumination of specimens in optical microscopy (the Köhler illumination) that seemed to allow for a greater and seemingly 'impartial' access to the minute details (and flaws) of phenomena than what had previously been possible with the naked eye or mind. Of course, that did not make scientists or philosophers who lived before nineteenth century innovations in technology any less 'objective'. Rather, objectivity has a history, Daston and Galison argue, insofar as new instruments like photography enabled a serious challenge to prior "idealist" truth claims—truth-claims increasingly seen as partial and tainted by *merely* subjective interpretations of the true "essence" of "nature." Scientific practice and the technical enactment of knowledge made possible by instrumentation, or what Baird (2004) calls "thing knowledge", constitutes the warp and weft of epistemological formation and sets the material conditions of possibility for derivative "truths" to emerge (Foucault, 2013; cf. Foucault in Rabinow, 1991: 60).

One way to achieve greater 'objectivity' of the overall situation in the hamlets was through the use of impersonal HES worksheets, which only required several checked boxes based on a given US adviser's judgment of an overall hamlet status. Moreover, the introduction of computation into Vietnam was an extension of what Lorraine Daston has called "aperspectival objectivity," whereby with the introduction of the computer, individual idiosyncrasies are eliminated through the mechanical "suppression [of] the universal human propensity to judge and to aestheticize" (1992: 599). Yet, the materiality of knowledge production should not be taken as an unproblematic enterprise, where "truth effects" seamlessly pop out for the taking; for instruments and devices, especially business machines, often pose more problems than solutions, unexpectedly knotting up the integrity of truth- claims despite the promises and apparent 'neutrality' of the technology – hence, the necessity of "technical support".

Problems within the HES emerged almost immediately after its introduction, particularly with regards to the integrity of data input, what I call the system's 'data anxieties'. Space does not permit a full explication of these data anxieties, but I can pinpoint three sites where the input data was called into question, placing the HES output into doubt. The first site was the interaction between the US district adviser and his Vietnamese sources. Following the overthrow of Diem, US military and civilian officials were suspicious of information coming from Vietnamese sources, given the reports of "progress" prior to Diem's assassination. As Legere (1971: 7) writes,

> The Vietnamese… were under great pressure from Presidential level [sic] to report impressive progress in pacification, especially through the strategic hamlet program, and it was on these euphorically optimistic reports of progress that

the US advisers were largely drawing.

The suspicion continued throughout the HES's operation, since US district advisers relied upon information from government-appointed hamlet chiefs and interpreters. Underlying the suspicions was, frankly, racism towards Vietnamese officials, who were perceived to be lacking in the art of responsible (Western) governance, and therefore prone to corruption. That said, the second site for anxiety increasingly focused on the subjective judgment of the US district adviser himself. Suspicions stemmed from the general lack of language training among advisors, which made them more reliant upon both their Vietnamese interpreters, and personal observation of security and development conditions. It was not until later in the war that US advisers began to be proficient in the language (predominantly Vietnamese) used in their districts. Language problems were only exacerbated by the relatively short tours (six months) advisers had in a district, as well as the general turnover in advisory personnel that comes with military rotations. As two of developers of the HES wrote,

> When a new US adviser enters the field, he may at first follow his predecessor's lead, or he may arrive wearing rose-tinted spectacles, or he may be in the depths of cultural shock; as he continues in the job, his changing attitudes and experience will inevitably affect his judgments.
>
> *(Clark and Wyman, 1967: 11)*

The US district advisor also experienced pressure 'from above' to report 'progress', and this often led to charges of advisers doctoring the numbers and "grade creep" (Daddis, 2011: 120; Tunney, 1968). As the war continued, accusations were leveled that US advisers did not even visit the hamlets within their districts, and made up numbers in order to speed up the paper-work requirements by the data system (Kolko, 1994: 241).

The third site of data anxiety stemmed from the numbers and how they were inputted into the system. A central problem within the HES was the inability to get an accurate count of populations and hamlets, which ranges in archival documents from 11,000 to 13,000 hamlets at any given moment. In a stunning admission at an intelligence conference in 1985, the chief architect of the HES, George Allen, claimed the numbers that went into the system were problematic from the outset, due to the nature of US military violence in the Vietnamese countryside; that is, the deliberate targeting of what Samuel Huntington (1968) once distastefully called the "bases of accommodation".

> I mentioned one thing that occurred was that we started with 13,000 hamlets. I think the demise of 2,000 hamlets was a result of, as much as anything, the sort of thing the Soviets are engaged in now in Afghanistan. In essence, much of our military operations, and in particular our bombing, tended to force the population to make a choice. Stay in the countryside and get killed, or get the hell out and get somewhere where you are not going to get bombed. And where you are not going to get bombed is in areas where Vietnamese troops are. That is why I think 2,000 hamlets disappeared in Vietnam and were no longer viable political administrative entities. It was just because they were wiped off the maps.
>
> *(Allen, 1985: 9)*

Therefore, hamlet evaluations were often preposterous insofar as

> populations deemed secure would include the millions of Vietnamese peasants who had been driven off their land, or

people massed in the proliferating refugee camps and shantytowns.

(Tyner, 2009: 103)

For the duration of the HES operation, the task for the US military and its affiliates (ARPA and the RAND Corporation) was to fix the reliability of the input, and the HES underwent several revisions (in 1968, 1970, and 1971), but never succeeded in erasing the subjective taint on the data input.

Data anxieties 2: Towards 'objective' cartography

If the numbers inputted into the HES were suspect, the credibility of the computer itself as an 'objective machine' was never in doubt. The signature output of the HES were the quantitative maps produced by the computer, which indicated the security status of the hamlets, giving commanders a monthly 'God's eye view' of things, and a total picture of the pacification campaign in South Vietnam. The "Province Hamlet Plot", as the maps were called, were touted by HES developers as an ideal 'management tool' for commanders. The quantitative maps were embraced because of their high-resolution images – every hamlet was represented by province, which made the ability to "chart change" an effect that could be *seen* month-to-month (Light, 2005: 43).

Through the use of monthly computer graphic plots of hamlets, commanders were able to witness a visual "progression and regression" of rural Vietnamese activity patterns. When a regression pattern appears, the factors contributing to the regression and the extent of their contribution are identified and analysed. This technique acts as a trigger mechanism, which activates appropriate responses within agencies responsible for restoring the situation in the regressed areas. Similar analyses are conducted to isolate factors contributing to progression for further "exploitation" (Brigham, 1968: 21).

A subtext to the uses of quantitative maps was the gradual displacement of manual cartographers within the US military, especially in Vietnam (for historical background, see Clarke and Cloud, 2000; Cloud 2002). Prior to the HES, cartographers within the US Army Map Service were only capable of producing "area-control" maps based on statistics provided by US advisors. Cartographers would overlay a grid over a province (at 5-miles per square), and proceed to manually color fill squares based on five area-control categories within the pre- HES reporting system: Secured, Undergoing Securing, Undergoing Clearing, Uncontested, VC Controlled (Clark and Wyman, 1967: 46). Then, using a broad-pointed felt-tipped marking pen, the cartographers would then draw the area-control boundaries over the grid overlay (see Figure 7.2).

After the HES became operational, the new quantitative maps were produced by SYMAP, a computer mapping program developed by Howard Fisher as the Harvard Laboratory for Computer Graphics and Spatial Analysis. The SYMAP maps were produced through rudimentary GIS databases developed by Fisher's team, where punch-cards were

inserted into a card reading system, and maps were printed using line printers with spooled paper. A prominent feature of SYMAP was "overprinting", where the paper intermittently stopped on the printer enabling thicker printing on the same line (Chrisman, 2006), and this method was adopted by MACV analytical cartographers for the new control maps based on *points* rather than *areas*. Such maps allowed the trick of 'objective progress' to be displayed in visual form, with "government controlled" areas represented in degrees of darkest ink (over 80 per cent government-aligned) to lightest ink (less than 20 per cent). Even though analysts were clear that the new quantitative maps were not area control maps – "the density of blackness at any given spot on the map is determined by the control indexes of all provinces whose geographical center points fall within a radius of a few inches" (Thayer 1975b, 21) – a commander or civilian quickly perusing the maps could easily walk away with such an impression, which secured the visual trick of showing 'progress'.

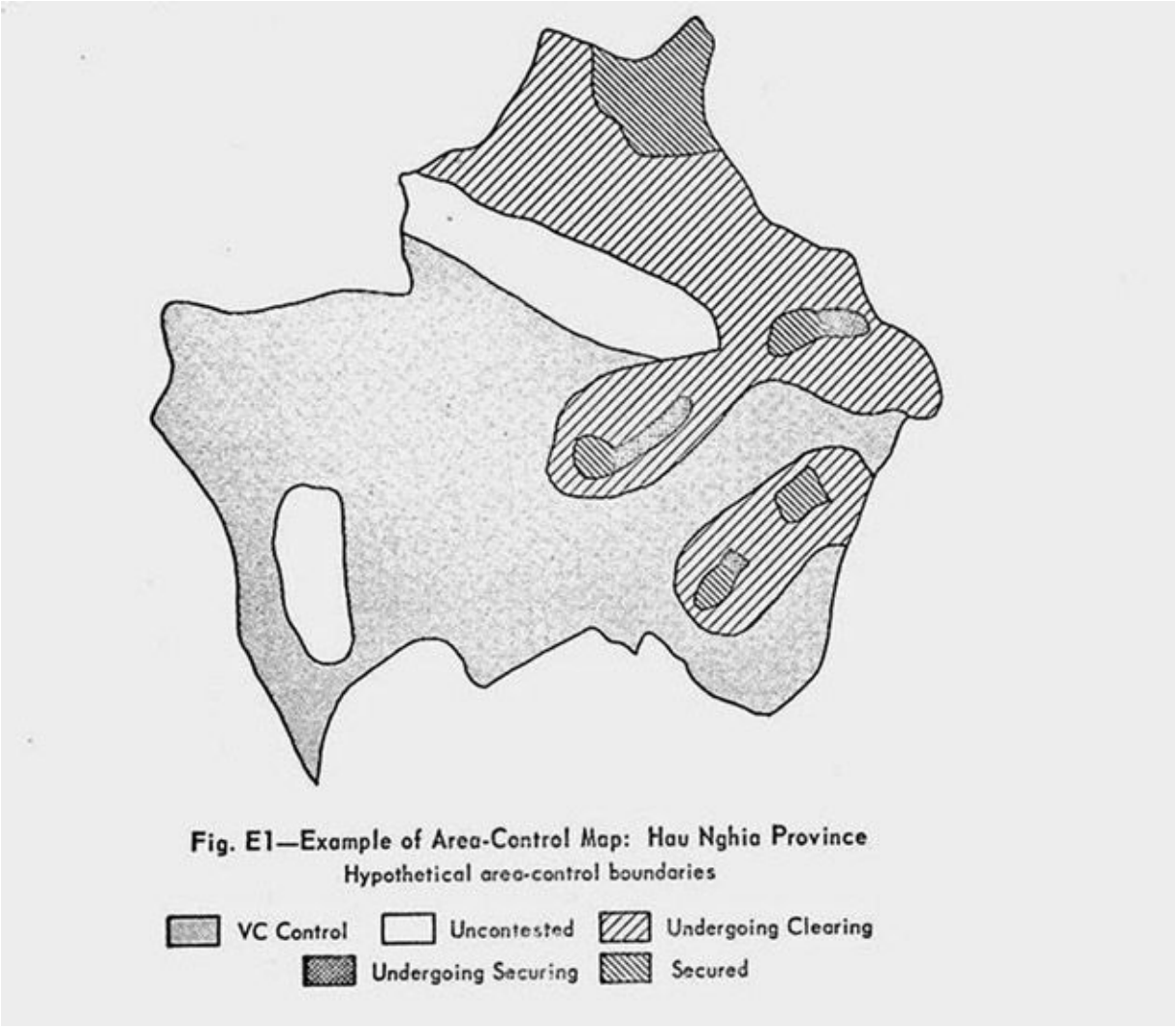

Figure 7.2 Examples of manual grid overlays and area-control maps produced at the provincial level

Source: Clark and Wyman, 1967

The human trace was never completely erased from the new HES maps, as the computer maps were always drawn upon or 'dotted' by their handlers (see Figure 7.3), but the subjective hand of the cartographer was no longer the leading force, as more 'precise' maps were produced by the 'objective' machines. Rather, the cartographer was useful only

insofar as his[6] professional "trained judgment" (Daston and Galison, 2007; see also Dyce, 2013) could be sought by amateur military map users.

Conclusion

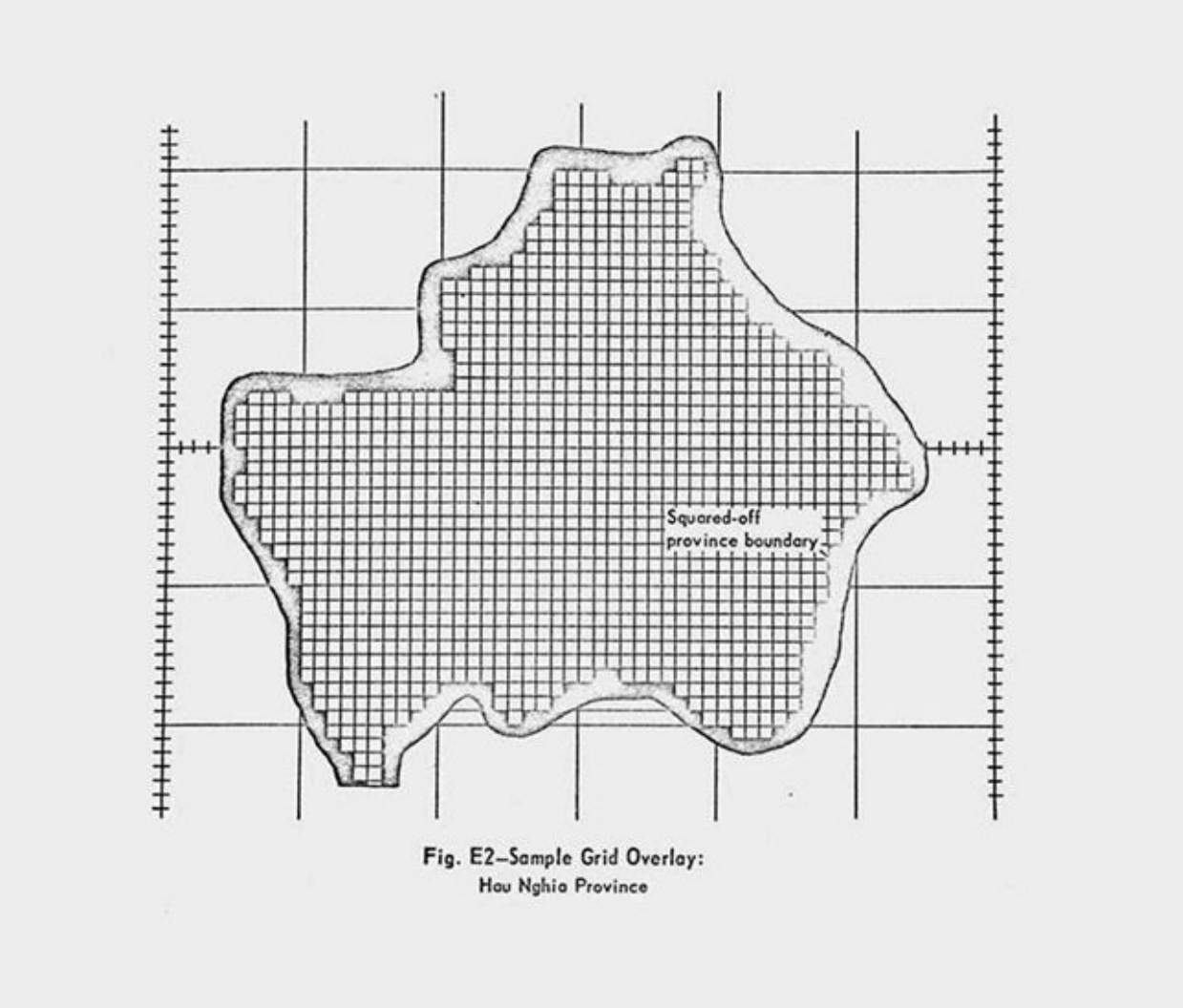

Figure 7.3 Hybrid HES maps, computationally-produced with manual additions of area-control

Source: National Archives, College Park, Maryland

The Hamlet Evaluation System was pivot point for a profound transformation within the US military in the 1960s, namely the displacement of the privileged place of 'subjective judgment' across scales within the US military, from the lower- levels of US district advisors and manual cartographers, to the highest-level of commanding generals. It is often forgotten that there was initially a great reluctance, especially on the part of senior military officers, to the institutionalisation of data-driven computational analysis pushed by McNamara within the Pentagon. Some military officers, especially those who viewed war as "an art, not a science", dismissed data storage and automation as nothing more than "ticket-punching", which could never substitute for the seasoned intuition of an experienced war general (Harrison, 1988). But the Vietnam War, characterised as it was as a "war without fronts", posed problems for individual observers, and anxieties over subjective interpretations of the war were increasingly treated as a limited perspective incapable of understanding the full spectrum of unconventional operations. Computers were held up as *the* modern fix to subjective perspective, capable of providing an objective

approach to the representation of the 'reality' in Vietnam. To be sure, the introduction of computers into Vietnam was an attempt at Western dominance against an anti-colonial movement, to digitally disclose and visually enclose the labyrinth intricacies of a colonised population. However, as I have attempted to show here, the calculating devices themselves structured the US military and policymakers' understanding of Vietnam, and were not merely an 'implement' or 'tool'. The order of appearances was never as it seemed, as the data anxieties surrounding the input data constantly called into question the accuracy what one was actually seeing in reports or maps. Despite these doubts, the real trick of the 'computational enframing' enabled by the HES was that system, to all appearances, turned Vietnamese hamlets into graspable objects that could be achieved through objective representation. The computer, and the subliminal abstract order it produced (hamlets, villages, provinces, UTM coordinates), cleared the ground for a new kind of violence that operated within the sinews of Vietnamese society and continues up to the present, a violence that targeted the hamlet, the local; a violence that promised precision, with an incalculable number of bodies left strewn along the horizon.

Notes

1 That is, if it was a data point in the system.

2 According to Daddis (2011: 121; original emphasis), "HES generated a monthly average of 90,000 pages of reports. When added to MACV's other analysis documents, the US Army alone in Vietnam was producing 14,000 *pounds* of reports *daily*".

3 For example, consider the Civil Operations and Revolutionary Development Support (CORDS) Chief, Robert Komer, defense of hamlet data at his December 1, 1967 news conference, held at the height of a propaganda blitz orchestrated by the Johnson Administration to extol the 'progress' made in Vietnam – a blitz that backfired as the Tet Offensive was launched on January 30, 1968. The Tet Offensive is commonly taken as the point where the US public in general turned against the war, the moment when Lyndon Johnson is to have said, "If I've lost Cronkite, I've lost Middle America." See Tom Buckley, "Komer Defends Data on Hamlets," *New York Times*, December 2, 1967.

4 As George Allen wrote in his memoirs *None So Blind* (2001: 219–220), the Strategic Hamlet programme only measured "inputs": "This had been a problem with reporting on the Strategic Hamlet program in the early sixties: the data simply reflected inputs, and there had been no systematic measurement of conditions in the hamlet after it had been certified as meeting the initial criteria for the program. Thus, only the measure of "results" was the ever increasing cumulative total of "completed" hamlets, with no reflection of their subsequent history, whether they continued to meet the criteria, or whether their status was eroded as a result of enemy activity."

5 For an important critique of the "body count", see Tyner (2009).

6 Cartographers within the US Army Map Service were invariably male at this time.

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8

‘Seeing Futures’

Politics of visuality and affect

Matthias Leese

Introduction

In a supposed age of 'big data', the amount of data that is constantly created, stored and processed by far exceeds the cognitive capabilities of the human brain (Anderson, 2008; Bollier, 2010). Mathematical and statistical tools have therefore emerged as a solution to this data overload and to help us to make sense of our data-driven environment. The most central technique for making sense of such data deluge is to render the results of analyses accessible through visualisation (Marty, 2009; Gresh, Deleris and Gasparini, 2012). However, "this rendering, even by photographs, is never innocent" (Rose, 2012: 2), and thus the translation from the algorithmic environment back into the realm of human-readability creates a large set of questions that address issues of how we perceive the world and how we make sense of it. The notion of the lost innocence of visuality has been pushed even further by post-modernists such as Baudrillard, who argues that what we have to deal with "is no longer a question of imitation, nor of reduplication, nor even of parody. It is rather a question of substituting signs of the real for the real itself" (Baudrillard, 1988: 167). Then, what are we seeing when we look at the visual outputs of the calculative devices of our times, and what are the consequences that we must derive from them?

This chapter looks at specific translations of algorithmic calculations into visualisations and engages with their impact on our mode of addressing the future. However, it appears more appropriate to conceptualise such visualisations as *visualities*, as they have to be understood as culturally (and politically) embedded (Davis, 2011: 8). Specifically, I will argue that in the cases discussed here, complexity becomes transformed into reductionist binaries that unfold a particularly 'dark' set of future narratives, as they turn fine-grained risk assessment into simple threat scenarios that must be acted upon. As Massumi (2005: 34) puts it: "without proof, without persuasion, at the limit even without argument, … image production could trigger (re)action." Anticipation then becomes dominated by an affective startle that intentionally seeks to override the full spectrum of contingency and prioritises a particularly bleak set of threatening futures that become folded back into the present. Thus, visualities will be conceptualised as affective triggers that shut down part of the imaginative spectrum through specific modes of non-representation. Building on Haraway's (1991) argument that visualities are necessarily tied to social power relations, I thus put forward a reading of visuality that, despite the implicit connection to its underlying calculative architectures, locates politicality in the rift between representation and non-presentation, and that is ultimately concerned with affective modulation (Thrift, 2004; Adey, 2010) as a mode of governing the future.

Translation I

In April 2012, users of the online payment system PayPal were puzzled, when all of a sudden little 'red risk flags' appeared throughout buyer and seller profiles on the PayPal website, indicating that the flagged transactions supposedly were 'at risk.' What was later identified as a technical glitch was for several days the topic of heated and angry discussions in PayPal's online "Community Help Forum." Customers were wondering what the risk flag meant, and more importantly, what consequences they should derive from the warning.

> I have received a payment "Complete" but there is a red flag "Risk Alert." When you click on it there is no explaination [sic!] as to what the risk is, or what Paypal expect me to do about it.
>
> *(User "KathK", 4 April 2012)*

> Just started getting these "Red Flag" risk warnings today. Seven payments, already four red flags. Rather derogatory of the buyer, especially if Paypal do not give you any reason for the warning. how do you decide on the warning when you have no info to make such a decision.
>
> *(User "Lynsey-Jayne", 5 April 2012)*

> This is getting more interesting by the hour – sure wish someone would tell us what the heck is going on here.
>
> *(User "jja7528", 5 April 2012)*

A common theme among most responses was the startling uncertainty about what was happening. Since no additional information was provided except for the visuality of the flag and the statement that something was not right, customers apparently felt anxious and angry at the same time. After all, business seemed to be at stake. Subsequently, people felt an immediate suspicion that their business partners could be frauds, criminals, or worse. But without an indication of the actual meaning of the flag, it could be anything. There was risk involved, so much was out in the open, but the flag itself completely lacked any evidence about the nature and immediacy of the particular risk. Was there a terrorist suspect involved, and the transaction unintentionally helped in the financing of a future attack? Was it merely an unconfirmed shipping address or a negative evaluation from past business? The flag itself remained silent about those questions. However, the mere visuality apparently required some kind of action nonetheless. Why is it then that such actionable priority is given to the visual layer, although largely devoid of robust information? After all, as Levin (1993a: 1) points out, "philosophical teachings repeatedly insisted on calling to mind all the dangers in placing too much trust in vision and its objects."

On calculation and (non-)representation

The reason for such preference of the visual layer arguably lies in the undeniable strength of vision. As Fyfe and Law (1988b: 2 original emphasis) have put it, "depiction, picturing and seeing are ubiquitous features of the process by which most human beings come to know the world as it really *is* for them". Debates on visuality have been manifold; however,

a particular strand of discussion has evolved around the question of 'ocularcentrism.' That is, whether a supposed primacy of vision among the human senses pre-structures our understanding of the world (Jonas, 1954; Jay, 1993; Levin, 1993b). Despite numerous challenges from constructivists, post-structuralists and post-modernists, such an understanding of vision is still rather widespread in the 'exact' sciences, and the broad academic field of information visualisation (infovis) has emerged around questions of the most accurate and meaningful way to represent insights from data. Such issues have drawn ever more attention since 'big data' has been heralded as "the new way to be smart" (Ayres, 2007). The toolbox of infovis is in fact stacked with elaborate measures of visual representation, including the likes of scatter plots, box plots, heat maps, 3D coordinates, link graphs, treemaps, node-link diagrams, and many more (see, for instance, Pousman, Stasko and Mateas, 2007; Marty, 2009: Ch. 3). Moreover, taking advantage of design principles that facilitate cognitive access, visual elements such as colours, positions, motions, orientations, size, shape, saturation, or hue (Bertin, 1981) have been incorporated to enhance the presentation, and thus the understandability of data. By asking questions such as: "What is the best way of visualizing data? What choice of colour best supports the communication of properties we are interested in? Does shape and placement help improve perception?" (Marty, 2009: 9), it becomes quite clear that the infovis community conceives itself as a field that seeks to provide neutral techniques that are completely devoid of politics.

Throughout the history of the many disciplines that have engaged with the idea of visuality, there have been many attempts to challenge such an understanding that largely disregards the social embeddedness of visuality. For instance, Virilio (1994) has prominently argued that the increasingly technological production of visualities resulted in an all-encompassing "vision machine" that defines our times, and that no one can escape. And in the same vein, Baudrillard (1988) has claimed that the constant production of images from and through the digital realm even disabled the possibility to distinguish between reality and fiction in the first place. For Baudrillard, Virilio's post-modern dystopia of the vision machine consists of a hyper-real assemblage of simulations and simulacra that mock the very idea of representation. If, as he argues, "representation starts from the principle that the sign and the real are equivalent" (Baudrillard, 1988: 170), this assumption dissolves with the advent of the digital age. Digital transformation and the manipulability of code rids visuality of obvious truths – it becomes *non-representational*. The ensuing question then is: if there are no genuine congruency claims left in the visual layer, where to turn the analytical scope of social and political inquiry? I suggest that the political moment of visuality must be located in the rift between representative calculations and non-representative images, and more specifically, in the performative impact of non-representational visualities.

Over 25 years ago, Law and Whittaker (1988) argued that a "politics of visualization" could be found in the choices of representational structures and thus linked visuality to the

representative processes of democracy. And while they upheld the representational link that post-modernism sought to tear apart, they put the analytical focus on the "contingent decisions taken during the production of visual depictions" (Law and Whittaker, 1988: 162), thus opening up an agenda for research on visuality that takes into account the specific conditions under which images emerge. Visuality indeed must be conceived as a result of social and political relations. As Rose (2012: 346) helpfully summarises, questions about the production of visualities should thus include space, time, authorship, technologies, transmissions and social impacts. How did the flag end up being a flag, instead of a skull and crossbones, or an actual figure telling us about the risk we are facing? Who were the actors involved? Alongside which contextual constraints did visual artefacts emerge? Who eventually decided upon their implementation? Sharing common ground with Virilio and Baudrillard among others, Haraway (1991: 189) pertinently claims that visuality today is embedded in a "technological feast" that has eventually turned into "unregulated gluttony."

In order to disentangle this mess, any analysis must necessarily focus on the practices, the decisions, the technologies, and on "the violence implicit in our visualizing practices" (Haraway, 1991: 192). In fact, such a notion is supported by Fyfe and Law (1988a, 2), who argue that

> it is relatively easy to talk about political struggle, scientific research, or the publication of official statistics without considering the specifically visual technologies that are built into and help produce them.

Critical interventions to explore the politicality of the production of visualities have also come from the field of infovis itself. Dörk et al. (2013), in their critical take on a "politics of visualization", suggest to: "consider the people involved and affected, the values and principles considered, and the intended and possible consequences of a technology", as well as to "examine how functional characteristics of a given artefact target particular groups or activities."

If we conceive of the production of visualities as something political, then what is the underlying rationale of such a politics? What is the vision of a political programme that operates through the visual layer? Following MacDonald et al. (2010: 4), it can be argued that

> staging, imaging, surveillance, simulation, display and so on have become some of the foremost activities of state in a bid to sustain or acquire power through the cogency of the visual.

Alongside such a reading of visuality, I claim that images should be read as part of a visual economy that steers our cognition and eventually unfold a concrete, actionable impact. It is not only about the question "How do we know what it is that we should pay attention to?" (Amoore, 2009b: 19), but also about the question 'What do we make from it, once our attention has been drawn?'.

Translation II

Another empirical example of such consequences can be found at the airport. Debates about visualisation and visuality have been quite intense with regard to more recently implemented full body scanners that are set to detect hidden objects under passengers' clothes. Fears about nudity and an intrusion of privacy and intimacy (Bellanova and González Fuster, 2013; Leese and Koenigseder, forthcoming) in some cases have eventually led to the implementation of a distinct visual solution (Mordini, 2010). Instead of the original X-ray or terahertz images, passengers now face a friendly-looking matchstick figure on a screen. On this matchstick figure, yellow-coloured dots indicate detections of potentially dangerous objects, and thus command a manual secondary screening in the indicated body area. The visuality in the first place is a simple trigger for the security personnel – however, there is more to it. In 2011, the German Ministry of the Interior conducted an official trial run with machines that featured such abstract visualities at Hamburg airport.

> After seeing which body parts were marked as detections on the screen, passengers often inspected their respective actual body parts with a worried look, even when it was apparent that the detection had been a false positive (e.g., when they were wearing a t-shirt and the yellow dot was "on the blank skin").
>
> *(Field Journal, 9 June 2011)*

> An old lady excuses multiple times for detections, even as they turned out to be false positives.
>
> *(Field Journal, 8 June 2011)*

The yellow dot on the screen says nothing about the advanced algorithms that are used for automated threat detection in image analysis, and it says nothing about probabilities or threshold values that eventually lead to the appearance of the yellow dot. However, the colouring intuitively establishes a negative association. For a split second, passengers appear to ask themselves: Even if I have no bad intentions and I carry no forbidden objects, might I be a terrorist nonetheless? At least the machine says so, so I should double-check? Arguably, the harmless yellow dot (in itself as innocent as the simple flag) has not only led the human gaze through the creation of attention, but it has also triggered something else.

On truth and omission

The central issue here concerns the performative role of visuality across the social. It is not a question of the image itself, but rather of its potentials, its dynamics, its power to create an impact. It seems rather subordinate whether we are facing a flag, a colour or an exclamation mark. When the answer is the creation of attention through the visual layer, then in fact: "whether a solution is good or not is not an objective but a political question" (de Vries, 2013: 28). A critical engagement with the political dimension of visuality allows us to analyse how a risk flag on the screen of a border guard gets travellers singled out from the mobility flow in order to undergo careful and intense scrutiny for the sake of cancelling out risk potentials (Amoore, 2009a). It allows us to understand how threat, and eventually the concept of terrorism, are translated into little yellow dots on a matchstick figure at the airport. And it allows us, so I argue, to advance towards an understanding of visuality that embraces non-representation and turns the long-gone distinction between reality and fiction into the core feature of a political agenda. As such, it erodes the: "association between visuality and truth-telling [that] strikes at the epistemological heart of Western modernity" (MacDonald, Hughes, and Dodds, 2010: 4). The reduction of complexity and the displacement of truth claims go hand in hand – and remaining visualities evolve around a principle of uncertainty. The threat risk that had been calculated by complex calculative devices becomes in fact re-translated into binaries that establish a "quasicausal operation [that] goes by the name of security" (Massumi, 2005: 35).

Apparently, the establishment of risk seems to be the very operation that is at stake here. Risk lies at the heart of a visual economy that craves for attention, as it has emerged as a primary mode of anticipation that supposedly enables us to capture and modulate the future (O'Malley, 2004; Aradau and van Munster, 2007; Amoore and de Goede, 2008). Simply put, risk translates future uncertainties into computable pieces, thus enabling the calculation of numeric scores from which 'objectified' statements about probabilities of future narratives can be derived. Risk is then nothing else but harnessed and commodified uncertainty (de Goede, 2008: 159).

However, risk as such is deeply grounded in the very representational claim that visuality undermines. The flag (properly named a 'risk flag'), the yellow dot, the exclamation mark, the skull and bones – they all appear to make a concise statement about risk, and as such represent the objective truth that had been calculated.[1] But they do so while omitting all underlying rationality we would expect. Visuality thus parts with its very link to any truth claims and as such becomes indistinguishable from Baudrillard's simulation that leaves us wondering what exactly we are seeing. But what does it mean to turn to the blank spaces and un-uttered rationalities (Huysmans, 2002: 52)? The omission, I argue, equals all that remains unsaid/unvisualised, yet still lingers at the non-visible edge of the visuality. It is the *non-represented* part which turns our world into a simulacrum.

The politicality of visuality relies on opacity instead of transparency, and on reduction of complexity and contextuality – until all that remains is a plain visual artefact that produces no clear statement but the garnering of attention. At first sight, a yellow dot is as is simple and featureless as a flag. It does not represent any fine-grained relations between data points, it does not state any magnitudes or relativities, and it does not say anything about the nature of the presumed threat or about what might be at stake. In Baudrillard's (1988: 170) terms, it enacts "the radical negation of the sign as value." Thus, if visuality itself has been rid of meaning, then how can we understand its performance? How can we deal with its non-representative nature that is detached of significance?

In his account of potential politics, Massumi (2007) has retraced how virtual threats are actualised through the logics of pre-emption. Pre-emption, he argues,

> is when the futurity of unspecified threat is affectively held in the present in a perpetual state of potential emergence(y) so that a movement of actualization may be triggered that is not only self-propelling but also effectively, indefinitely, ontologically productive, because it works from a virtual cause whose potential no single actualization exhausts.
>
> *(Massumi, 2007)*

What does that mean with regard to visuality? We have so far retraced the emergence of visualities along the translation of data into insight, insight into risk, risk into visuality, and through the visual layer eventually back into uncertainty. It is through this notion of deliberately produced uncertainty, as has been argued by Carter and McCormack (2010: 107), that "a sense of corporeal disquiet, a knot in the stomach, a visceral unease" enters the scene that is staged through visuality. What enters, in fact, is the affective register.

Affective modulation and the unfolding of bleak futures

For Massumi, affect is placed in the very centre of a politics of potential. It is the crucial element that connects future uncertainties with actual action. As he argues:

> Any time you feel the need to act, then all you have to do is actuate a fear. The production of the effect follows as smoothly as a reflex. This *affective* dynamic is still very much in place.
>
> *(Massumi 2007; original emphasis)*

In the examples provided in this paper, analytic complexity has been reduced to the point where calculated risk is folded back into visually transmitted uncertainty, and rational decision-making is overshadowed by an affective need to act upon the future. However, as Carter and McCormack (2010: 106) claim:

> Affectivity is not necessarily something that undermines thinking, nor is it something through which thinking must penetrate in order to reveal some deeper, more transparent truth. Rather, for better or for worse, affectivity is part of the moving grounds from which thinking … emerges and is cultivated.

Conceived of as affective triggers, visualities have the potential to radicalise what was once elaborated probabilities, and to compress them into an urgent dichotomy of threat/no threat. It is not necessarily the process of thinking and decision-making that is crossed here – but, through the disruption of the representative truth claim, what should be framed as a question ("Is there a threat? And, if yes, what is its nature?") becomes transformed into an exclamation that seemingly leaves no choice but to act in order to find out. Pre-emption, however, cares very little about truth – only in a twisted fashion that establishes truth as the end-product of the actualisation of the virtual. Hence: "truth, in this new world order, is by nature retroactive. Fact grows conditionally in the affective soil of an indeterminately present futurity" (Massumi, 2007).

Thus, if affect is the central mechanism for such pre-emptive logics, its modulation becomes the prime target for any politics of visuality. Geography scholars in particular have long been concerned with the possibility to target the affective register. Thus, as Anderson (2009: 80) argues, affective atmospheres can be "'enhanced', 'transformed', 'intensified', 'shaped', and otherwise intervened on", while MacDonald et al. (2010: 4) claim that they indeed "prefer a messier, affect-orientated understanding of visuality." If the message of post-modernity is 'Don't trust the image!', then the visuality will startle you nonetheless. As Massumi (2007; original empasis) puts it:

> you trigger a *production* of what you fear. *You turn the objectively indeterminate cause into an actual effect* so you can actually deal with it in some way.

As is hopefully apparent by now, non-representational visuality creates a deliberately vague space of (threat) imagination. In a crafty move, a risk flag puts forward an argument without an argument. A yellow spot on a digital matchstick figure upsets passengers to such extent that they question the integrity of their own body. Or, as Massumi (2005: 32) frames it, such an undistinguished mode of visuality presents: "no form, ideological or

ideational and, remaining vague as to the source, nature and location of the threat." It intuitively appears to the beholder that some deviance is pointed out – but deviance from which norm and to what degree? After all, what is the 'normal' state of security in a world that at times appears so radically contingent that the full spectrum of possibilities must be anticipated in order to create a 'secure' and productive life? And how exactly to act upon a colour, a shape, a flag, when it is not only unclear what is wrong, but also what is right?

'Big data' and the exploitation thereof have arrived with the promise to solve the capacitive overload that our contemporary world poses – or at least that is how the positive reading of current euphoria goes. And yet it seems that the riddles of how to make sense of the world and eventually act upon it have rather been transformed than tackled. Visualisation, closely entangled with the algorithmic analytics that extract meaning from databases, was set to assist human cognition – but the disrupted truth claim of the digital 'vision machine' appears to have overstepped the mark. Where Amoore (2009b: 22) argues that "algorithms precisely function as a means of directing and disciplining attention, focusing on specific points and cancelling out all other data", the politicality of visuality advances one crucial step further. Data and calculation themselves are cancelled out. What was algorithmically dragged into the realm of human cognition, subsequently becomes re-veiled into an obscure and indeterminate message that the individual is left with to decipher. What appears on the visible surface of the data-iceberg is a vague suspicion, and more importantly, a trigger that unfolds a bleak set of futures. In that sense, thinking about visuality has to be linked to the debates on anticipation through worst-case thinking (Clarke, 2008). However, while most analyses of anticipatory imaginaries focus on security professionals and domain expertise (Bigo, 2002), cross-cutting impacts of the economy/industry (Amoore, 2013), the role of the media (de Goede, 2008; Grusin, 2010), or the acting out of futures through simulations and exercises (Adey and Anderson, 2012; Boyle and Haggerty, 2012), visuality unfolds its futurity in a different fashion. Following Thrift (2004: 58), affective modulations "are not only being deployed knowingly, they are also being deployed politically … to political ends: what might have been painted as aesthetic is increasingly instrumental." Arousal, suspicion, or fear are but some, although powerful instrumental registers of such political affect – and as has been shown, they can effectively be crafted through simple visual artefacts.

A turn to affect not only allows us to understand the fluid nature of preemption and to challenge the primacy of representation as the basis for thinking, knowing and politics (Carter and McCormack, 2010: 103), but a politics of visuality that thrives on the notion of affect also offers other advantages. First of all, affect introduces a radical element of openness. Building on an understanding of affect that derives from the works of Spinoza and Deleuze, Anderson (2012: 34) suggests that "affective life is the non-representational 'outside' that opens up the chance of something new" and connects affect to the Foucauldian notion of security as apparatuses of biopolitics that intervene into life at the species level. However, for Anderson (2012), in affect arguably lies the element that

perpetually escapes the complete command of regulatory regimes. Affect is located in the realm of contingency, implying both threat and opportunity for security/economy and therefore becomes targeted through a supposed organisation of affective life that albeit will never be fully capable of grasping its liquid characteristics. A politics of visuality, I argue, thrives exactly upon such radical openness. Through the refusal of even remotely accurate statements, non-representational visualites deliberately trigger the contingent characteristics of affect. Their interpretation remains open. They can be acted upon in one way or the other, but they eventually have to be actualised in order to escape the realm of virtuality. In fact: "the autonomy of affect is its participation in the virtual. Its autonomy is its openness" (Massumi, 2002: 35).

Secondly, a scope on the affective register rids a politics of visuality of the framework of encoding and calculating that at times appears dominant in any contemporary political analysis. Without neglecting the need to plunge deeper into practices and knowledge of particular assemblages, the notion of the "dividual" of control societies (Deleuze, 1992) from an affective angle must be replaced. Visuality and affect do not attempt to break up the individual into calculable pieces, but rather target the body-as-a-whole. It is not so much about the steering of the individual, but about the drawing of attention. It is not so much about reassuring through knowledge, but about unsettling through uncertainty. And eventually, it is not so much about prescribing one definite interpretation of the world, but about encouraging reflection about threat and its possibilities. Put simply: a politics of visuality is not about addressing rationality, but about evoking emotions.

Finally, affect circumvents the ever-present question of agency that looms around the inextricably interlocked notions of knowledge and decision – more than ever in a digital era. As Derrida (1994) argues, human decision-making must necessarily remain disconnected from knowledge production as a distinct category, as otherwise human agency itself would become folded into the machine and no longer remain a conscious act. Certainly, this notion of human primacy in the realm of agency has been profoundly contested by scholars of actor-network theory (for an overview, see Latour, 2005) and more recently by the "material turn" scholars (e.g., Connolly, 2013; Acuto and Curtis, 2014). However, what is targeted through affect is rather the mode of decision-making than its knowledge basis. "Decision, if there is such a thing, is never determinable in terms of knowledge" (Derrida, 1994: 34). But it would then become obsolete as both deliberate action and analytical category. Indeed, the advent of the digital age has profoundly challenged the way philosophers understand foundational concepts in philosophy, such as mind, consciousness, experience, reasoning, knowledge, truth, ethics and creativity (Bynum and Moore, 1998: 1), and much (digital) ink has been spilled on issues of transformations in knowledge production and their legal and political impacts (Amoore, 2013; Rouvroy, 2013). Non-representational visuality, however, creates a cognitive situation in which that knowledge remains undisclosed and, thus, although acquired, does not unfold a rational impact. This does not mean that affect would be completely removed from discourses of

knowledge. In fact, as Thrift (2004: 60) points out, affect should be thought of as: "a different kind of intelligence about the world, but it is intelligence none-the-less." As such it provides an actionable, yet not fully rationalised, basis for decision-making.

Considering these points, the initial question concerning the politicality of visuality must be slightly re-framed. When looking at how affective engineering is practiced through the visual layer, an empirical agenda must analyse how visualities impact the social and as such materialise a political dimension that emerges through affect. As Anderson (2012: 40) puts it, "how are affective relations and capacities known and intervened on through specific apparatuses?" Adey (2010), for instance, has engaged with the affective dimension in mobility regimes, and, more specifically, with questions of the "motivational capacities of affect to provoke specific emotions and movements in a physical sense" (Adey, 2008: 440) through architectures in aeromobility. In a similar vein, Thrift (2004: 64) has analysed the affective capacities of urban life, arguing that:

> affect has always been a key element of politics and the subject of numerous powerful political technologies which have knotted thinking, technique and affect together in various potent combinations.

The present paper clearly does not function on the same level as these detailed and empirically-rich accounts. Instead, I have opted for an analysis that started from the actual impact of visualities (admittedly, in a rather limited fashion) and then sought to retrace the mechanics of such impact. Eventually, the argument I put forward here can be summarised as follows: in a political sense, visualities can be read as affective triggers that create an immediate atmosphere of suspicion. As Anderson (2009: 80) puts it,

> the concept of atmosphere is good to think with because it holds a series of opposites – presence and absence, materiality and ideality, definite and indefinite, singularity and generality – in a relation of tension.

Here we can find the elements of the visualities discussed above. Through the visually mediated dichotomies of risk/uncertainty, rational calculation/ indeterminate non-representation, and present warning/absent reason, a politics of visuality indeed strives to achieve "active engineering of the affective register" (Thrift, 2004: 58). When affect is determined by its radical openness, such a politics arguably thrives on that very openness. It is not disruptive, but empowering in such a way that through visuality emotions are evoked. At the same time, however, the political move of affective modulation deliberately seeks to shut down parts of the contingency spectrum. It is the unsaid/unvisualised element that unfolds a threat/security imaginary that evolves around narratives of undesirable futures that include fraud, financial loss, illegal immigration, mass casualties and many more catastrophes – if one only contemplates long enough. A suspicious atmosphere thus prioritises a distinct set of negative narratives over possibly more positive others. The future, though contingent as ever, suddenly appears particularly bleak and requires pre-emptive action in order to prove the imaginary wrong.

Conclusion: seeing the future, governing the future

This chapter has sought to put forward an analysis of a politics of visuality that is based on complexity reduction and the creation/modulation of affective atmospheres. The argument presented here is mainly a theoretical one, albeit one that is strongly connected to existing practices outlined in the two translations. Visuality is a powerful element of any assemblage of governing techniques (Amoore, 2007; 2009b), and its politicality must not be reduced to its production, but extends throughout its impact. As has been argued by Dörk et al. (2013): "depending on the intention of the designer, visualizations can be used to influence, manipulate, and empower viewers in many ways." As I have claimed here, indeed something crucial happens along the processes of translating databases into knowledge, and subsequently knowledge into actionable visualities. When, at the interstice of the artificial and the human realm, complexity is turned into dichotomy, simple visualities, such as flags or colours, ridicule the very possibility of definitive knowledge. The original truth claim of representation has indeed been torn apart. When visuality becomes non-representational, we cannot know whether we face reality or, as Massumi (2002) frames it, virtuality. The former truth claim is then nothing but a mere cry for attention, albeit one that arouses startle, attention, and an instinctive suspicion of the future.

While implicitly referring to algorithmic calculations, the results of such calculations are never explicated, and subsequently no real statement is put forward. In this vein, Massumi (2005: 35; original emphasis) argues that the futurity of threat "casts a present shadow, and that shadow is *fear*". Indeed, it is not so much the explicit utterance of a definite threat, but the openness of interpretation upon which a politics of visuality thrives. And however simple, featureless, artificial, and devoid of actual content – visualities still can potentially shut down the positive, hopeful part of the contingency spectrum. As such, visuality might be considered an everyday banality that does not deserve a particular amount of academic interest. However, it is exactly this notion of the everyday that has drawn attention from critical security studies. As Huysmans (2011: 375) argues,

> securitizing in contemporary world politics develops significantly through unspectacular processes of technologically driven surveillance, risk management and precautionary governance. These processes are less about declaring a territorialized enemy and threat of war than about dispersing techniques of administering uncertainty and "mapping" dangers.

For him, it is precisely those "little security nothings", like a tiny red flag attached to a PayPal payment, like a yellow dot on a matchstick figure, that drive and reinforce a political agenda through the intertwining of security and everyday activities, thereby ridding it of the burden of the public argument and the critical moment of decision about exception (Huysmans, 2011: 376).

I would like to advance a reading of a politics of visuality as exactly such an apparently technocratic discourse of regimes of (security) government, that quietly and not very

spectacularly infiltrates everyday life, and that should be critically engaged with. Visuality, from such an angle, presents itself as yet another mosaic piece in the big picture of contemporary governmentality, adding an affective layer of openness rather than explicitly prescribing fear, but making an efficient impact on anticipatory politics nonetheless.

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Note

1 It should be noted, however, that the notion of representation in calculation is of course highly controversial in the first place. There are no ‘objective’ measures of the world, despite the fact that the concept of risk is often presented in that way. My argument here is not so much about this debate, but puts forward the claim that visuality moves beyond the very idea of representation, and as such escapes possible challenges.

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Part IV

Affective devices

9

Love’s Algorithm

The perfect parts for my machine

Lee Mackinnon

Introduction

This chapter will begin to explore the expansion and limits of rational calculus in the domain of love, looking in particular at its manifestation in the context of online dating platforms. Romantic love in this case will be considered *a calculation of chance*. I trace such formal-logical manifestations of modern romantic love back to the 1600's, where games of chance (of which love was one) gave rise to the probability calculus. It has been claimed that literature was engaged in mobilising and democratising loves' prelude as a chance encounter that might rather be considered a technique of probability (Luhmann, 1986: 143). Thus, despite its apparent reliance upon chance, love becomes a biopolitical technology – contractual, regulatory and homeostatic.

I consider such terms in lieu of a present defined by the ubiquity of the digital algorithm and Internet dating platform, analysing data modelled from an anonymous dating site and noting the limits of rational models in calculating romantic decision. Forms of probabilistic calculation are seen to become ever more indeterminate as the means of calculation accelerate, exposing the formal calculation of chance, so critical to biopolitics, as entirely contingent. Indeed, biopolitics was characterised by probabilistic techniques that might facilitate the governance of all forms of life.[1] Two types of logic are considered to exemplify calculative paradox. In the first case, the logic of the *exception* formulated by Agamben (1998), where all calculation leads to a condition of indeterminacy; rationality and irrationality becoming confluent and interchangeable. I move on to explore the incomputable, after Chaitin (2007). In this case, reason and logic are seen to be inclusive of indeterminacy and randomness. Calculation thus becomes infinite and recursive, indicative of a wider cultural condition (Parisi, 2012: 13–14). If contemporary calculations of chance become increasingly profligate and randomised, then love's capacity to calculate chance is also accelerated. This will be seen to be the condition of the online dating platform, where we confront a situation of incomputability. I will then look to *Tinder*, the smartphone dating app, and trace the logic of such devices to the film *Her*, where love is enacted between man and the calculative operating system itself.

Media

In the case of modern romantic love, it is arguable that what once appeared to be the result of emotional, affective or otherwise inexplicable forces, has long been the result of algorithmic computation and calculus. Thus, according to Weber (2009: 345), the realm of erotic love was pitched against the rational, mechanistic culture of industrialised production, and elevated to a realm of sublime conscious enjoyment. Love was the *real kernel* of life that made increasing rationalisation acceptable, and was thus invested with irrationality, ameliorating the banal routine of rational working life (Weber, 2009: 345–347). Here, the calculative remit of romantic love is indicative of rational axiomatic function, even as it seems to epitomise the irrational. Romantic love was a calculation of chance that could restore the subject to a sense of predestination and provide respite from the workaday routine of industrialisation, whilst aping and normalising its disciplinary structures.

From 1800, the distribution of literature is believed to form the basis of a *discourse network*, in which the printed book is considered a storage technology that precipitates latter day technologies of memory and calculation, such as digital computation (Kittler, 1990: 161). Romantic Literature is considered *"a virtual media technology",* distributing the idea and conduct of love (Kittler, in Winthrop-Young and Wutz, 1999: xxxv). Forms of media also *supplement* love – its written form providing loves prelude, even exceeding love and the subject:

> Writing in the age of media has always been a short circuit between brain physiology and communication technologies – bypassing humans or even love.
>
> *(Kittler, 1999: 216)*

As in the case of reader and text, the discourse of the other is that of a cybernetic circuit that attempts to stabilise and expedite the passage of information (Kittler, 1997: 45; Lacan, 1988: 296). For Lacan, the other is based upon an essential misrecognition of the projected self (2004: 188). This (mis)recognition consists of an imaginary realm that begins when the subject first mistakes their mirror image as a fully constituted self, a misconception that must be sustained and augmented by symbolic means, having no underlying structural determination. Between subject and image, self and other, is a gap that arguably necessitates the potential for love to be at all (Agamben, 2007: 57). The terms of such a gap are today arguably negotiated by the transparency of technological medium. The *other* might rather be considered a field upon which the *self is imposed*, a point confluent with the digital interface as a particular kind of mirror: its protocols and editing tools involving systems of layering, masking and filling, in which self and other become elements of idealised machinic continuity that is never a misrecognition, always an artefact. In the case that the self is artefactual, it may seem that the imaginary loses its capacity to negotiate fantasy *as fantasy*. The continuity of such self-production as image can perhaps be considered a form of excessive narcissism that serves to eliminate the gap between self and

other, or self and image. Such conflation can be noted in the relationship between subject and digital device, where the interface creates immanent and immediate presence. Immediacy is again reflected in the connective speed of the Internet, which instigates a sense of continuity and intuition- naturalising the appearance of the device as a seamless extension of the body (Galloway, 2004: 66,67). Indeed, it is the protocols[2] that constitute the Internet today that provide "*etiquette for autonomous agents*" (Ibid: 75). In contemplating online dating, I consider the immanence of such protocols to assume love's very prelude and temporality. For example, direct proclamations as to be 'looking for love' outside of an online context would likely be considered desire based upon expedience rather than the particularity of the other. In the unfolding temporality of 'real-time' romantic love, longing and duration were integral elements of its prelude, tied to the technologies that defined its temporality – and here we might cite the romantic novel, which, like the painstaking passage of the love letter, holds its reader in suspense:

> How I envy Valmont! … It is he who will deliver this letter to you, while I, repining afar, drag out my painful existence in longing and misery.
>
> *(Laclos, 1988: 155)*

Today, the gap between self and other and the space of temporal suspension appear to diminish in favour of immediately quantifiable coordinates that coalesce around the subject's immediate desire. In the context of online dating platforms, the potential lover becomes a list of discrete *menu's* – increasingly informational and calculable, considered in terms of the *user's* ability to *control/ command/ alternate/ delete*. Human attributes can be mapped on to the technical devices, whereby the potential partner is assembled according to techniques associated with digital processing: editing, construction, choice, convenience, ubiquity, obsolescence, discretisation – features associated with digital technology and its protocols. Here, speed may be associated with the elision of meaningful translation between one and the other that can ameliorate desire only by eliding the threat of any gap with the immediacy of a new object or 'gadget'. As the potential for encounter accelerates, the discomfort of longing can be dispensed with and the subject given over to the prophylactic of instantaneous novelty. The bypassing of mediation can itself be a form of pleasure – the collapse of distance and intervening space in which a shift from *one to the other* also bypasses meaning, is a form of intoxication (Baudrillard, 1993: 70). The narcotic tendency of such elision is already present in the rapid existence of sites and organisations that aim to ameliorate the symptoms of accelerated connectivity. This can be seen in sites such as *Hetexted.com*, echoing Platonic pharmacological logic, where what is causative is also curative.[3]

In a recent study, researchers asked participants of an online dating site to assess their *market value* in relation to response from other site users, and thus how often they changed their online profiles in an effort to become more desirable (Heino et al., 2010: 436). In extreme cases such quantitative evaluation led to "'real-time' estimation of market worth based on checking email inboxes… similar to the way day-traders check online

stock- market indices" (Heino et al., 2010: 436). It is suggested that increasingly "inventoried" qualities have the effect of reducing the search for a partner into a "*numbers game*" (Ibid: 438), where one must go on as many dates as possible in order to increase one's *chances* – "hedging one's bets" in case an investment did not work out (Ibid: 439). Arguably, such sites may seem to make visible calculations previously obscured behind the vagaries of romanticism; yet, they also objectify through increasingly refined metrics, the particularities of partner selection – an objectification (or abstraction) confluent with the acceleration of technical production and obsolescence. Indeed, the digital algorithm becomes the very overture or prelude of love in place of chance. For example, chance was posited by romantic literature as the medium calculable by love, shifting two subjects into a seemingly predetermined and bonded fate. It was the chaotic outside against which the machinations of probability could effect determination, bringing the subject into a framework of economic rationality. Today, capitalist reality is considered by some to effect a Möbius topology, whereby inside and outside are entirely conterminous (Agamben, 1998: 37). Capitalism appropriates and permeates what may once have appeared its defining and chaotic outside. The increasingly refined metrics that constitute life as calculable data ramify probability, and, in attempting to eliminate chance, odds are continually redistributed, eventually being beyond systems of human calculability.

It is not clear how we might measure the efficacy of matching algorithms used by online dating sites, and whether they lead to more successful relationships. Although we have no direct access to these algorithms, we can analyse simulations that model the data from such sites in order to test the efficiency of matching algorithms more broadly. Thus, we can look at the way such a study formulates rational choice, rational actors and must necessarily base its ability to predict upon primitive assumptions. In so doing, I note the increasing confluence of rational and irrational function, later tracing such indeterminacy into the terrain of incomputability. I also note the ability of the algorithm to quantify widely disparate qualitative experience.

Algorithm

The Gale-Shapley (GS) algorithm was conceived in a 1962 paper entitled '*College Admissions and the Stability of Marriage'*, in which the writers set out to remove uncertainties in admissions procedures for universities, devising a system that demonstrates no instability in assignment. An assignment is: "optimal if every applicant is at least as well off under it as under any other stable assignment" (Gale and Shapley, 1962: 10). In trying to solve the issue of stability, the possibility of the same number of applicants as places is considered "highly unnatural", and the writers look to the model of a community of men and women, in which an even number of members are ranked according to individual preference for marriage (Ibid: 11). Stability is attained through a protocol of repeated rounds of offer-making and rejection; hence the algorithm is known as the *deferred acceptance algorithm*. Instability is considered the condition whereby a man and woman, who are not married, prefer one another to their actual mate (Ibid: 11). The writers ask whether "[f]or any pattern of preferences it is possible to find a stable set of marriages" (Ibid). It is claimed that the GS framework is a seminal benchmark in economic analysis of marriage markets (Ariely et al., 2006: 3). Indeed, the creators received the 2012 Nobel Prize in Economics for this work.

Ariely, Hitsch and Hortaçsu (2006) have used data from an online dating service to simulate stable matches between men and women using the GS algorithm, basing their simulations on estimated preference profiles (Ibid: 3). The stability attained via offers and corresponding rejection, reflect the process of email exchange between site users (Ibid: 14). While *actual behaviour* cannot be described, the GS algorithm can capture some "basic mechanisms in the dating market" (Ibid). Available data includes second-by-second accounts of user activity (Ibid: 6). Match outcomes are simulated using the GS algorithm, and correlations observed in mate attributes (Ibid: 1). The authors note the GS algorithm can also predict sorting patterns in actual marriages, if they exclude the *unobservable utility component*, *search frictions* or *error terms*, such as *mistakes* made by the user in searching (Ibid: 1), a point to which I return below. Online data is considered more accurate in representing choice in mate-preference due to the fact that it can be directly observed, previous studies being reliant upon reported preference (Ibid: 1).

The study details information of 22,000 site users in two US cities over a period of three and a half months in 2003 (Ariely et al., 2006: 3,6). All profile data is either numeric or multiple choice and thus easily storable and usable in statistical analysis; more personal essay questions were too 'unstructured' to be usable (Ibid.: 6). Profile photographs are utilised to "construct a measure of the users' physical attractiveness" (Ibid: 6). The writers ignore *strategic* behaviour in users, claiming that the online environment reduces the cost of non-trivial behaviour a priori. For example, the cost of sending an email and being rejected is negligible compared to the equivalent cost of rejection in an offline encounter

(Ibid: 14).

The authors consider various *"attribute trade-offs,"* for example, between looks and income: how much additional income would an *"unattractive man"* need to earn in order to be as successful with women as those in the top decile of attractiveness? (Ariely et al., 2006: 27). Over half surveyed Internet dating site users 'claim' to be looking for long-term relationships – from this, the authors infer that they are seeking marriage, even suggesting that those who claim to join the site through 'curiosity' simply wish to sound 'less-committal' (Ibid: 7). Under this assumption, they round up the percentage of activities to this end from just over 50 to 75 per cent. Evidently, the chosen utility value excludes many other implicit utility values at work. That people state marriage status online is taken as an indication that users are preoccupied with marriage, rather than the result of required pro-forma, which itself makes primitive assumptions about users and leads responses.

The writers utilise census data for the same geographical location and note strong degrees of sorting in terms of age, years of education and income (Ariely et al., 2006: 28). They look at geographically non-specific sociology/psychology studies for sorting along physical attributes, using this offline analysis as an empirical benchmark, against which they can measure the online data predictions. By changing the utility specification, data can be modelled again; setting the utility component regarding 'looks' to zero, the authors infer that correlation in looks might rather be driven by preference in income or education (Ibid: 34). Similarly, by including *only observable attributes*, leaving out (for example) the issue of 'shared interests', they note that unobservable factors play an important part in formation of online matches. This means that online dating may make it easier to find a partner along unobservable search terms, such as 'shared interests' (Ariely et al., 2006). The authors claim the GS algorithm predicts the structure of online matches 'quite well,' noting with some surprise that it also seems to correlate with offline marriage prediction and 'tentatively' suggest that the GS algorithm is close to efficiency in the GS sense (Ibid: 36).

Evidently, the research functions to make the system of its own analysis and calculation paradoxical, presenting a flawed determinism that has its basis in a contingent rationality provided by the model that it serves. Agamben (1998) has described such logic using set theory to explore the paradoxical situation of being simultaneously demonstrative of a situation and excluded from it, a condition illustrated by the *exception and example*. The example is demonstrative of a situation only by being removed from it, and the exception proves the rule only by exemption (1998: 21). In every logical system, just as in every social system, the relation between outside and inside, strangeness and intimacy, is thus complicated (Agamben, 1998: 22).

The paradoxical exception is applicable to terms beyond the Rational Choice Theory, thus, to say "*I love you*" is an utterance that cannot be understood in the normal context of language, yet must be treated as such. It is an *example* that suspends its own singularity in order to demonstrate its belonging to a broader class of generalised meaning (Agamben,

1998: 22). In this regard, love is also exceptional declaration *"a priority asserted in the style of the sovereign statement"* (Luhmann, 1986: 95,96), demonstrating its position as law and exception from law. In not belonging to ordinary language, it expresses the very heart of linguistic meaning (Agamben, 1998: 50). Its performativity is executive of a meaning both within and beyond linguistic function, giving us the ability to problematise binarisms, such as the axis of rationality and irrationality, along which love tends to be split.

The logic of the GS analysis evinces such paradoxical contradiction, whereby all values can only suspend the meaning attributed to them, and where meaninglessness takes on the quality of a meaning that is continually deferred, excepted, evacuated. In set theoretical terms, all such calculations lead to the empty set and the function of such algorithms flickers between indeterminable states of rationality and irrationality, demonstrating the situation that they are simultaneously excluded from. The imposition of a rational, mathematical model can demonstrate only the limits of the model, rather than conditions inherent in the data. Rational Choice and Game Theory are, by definition, systems of strategic choice and mathematical modelling, whereby *rationality* is deployed toward the fulfilment of desire (Laver, 1997: 2). Modelling according to game theoretic logic introduces biases that appear 'rational' until confronted with a different mathematical model, exposing them as "*artifacts created by the limitations of the model*" (Delanda, 1991: 86). Yet, while it is easy to dismiss the contingent nature of this study, the results may also begin to break open the notion of love as the condition of an opaque, incomputable malady, releasing us from other less desirable considerations. For example, factors such as likeness in income and education may already be elements in offline partner selection that are less salient due to the fact that the social institutions, in which meetings take place, are already modes of sorting (Ariley et al., 2006: 1). On the other hand, we should be equally wary of mapping the tenets of behaviours after the logic of a rational economic model that further naturalises such preferences as an a priori condition of human behaviour, rather than a contingent factor amongst others.

The "*error term*" is considered by the authors of the study to be "noise" – or "*randomness*" – in user behaviour. They claim that searchers' sometimes "make mistakes" when contacting someone – although, evidently, the distinction between deliberation and mistake is defined by the nature of the chosen utility term. The "*error term*", they explain, may also be a utility component that is observable to the site user, but not to analyst-researcher (Ariely et al., 2006: 4). I suggest that these two *unobservables,* or perhaps, *incomputables,* might serve as a definition of love more accurate than any of the authors' complex calculations. Indeed, arguably, uncertainty as to love's true or erroneous nature is the essential instability upon which love is based. For Luhmann (1986: 46), love's code has its basis in inference and anticipation and must seek to stabilise this essential instability. Love may then be described as the very process and tension of distinguishing between true and/or feigned states, an aspect that has historically been exploited in its role as a game.

Gaming

The element of *gaming* has become increasingly ubiquitous with the rise of online platforms as the feature of a system that becomes increasingly both random/ calculated and rational/ irrational, and in which play assumes the form of labour. In some recent online applications, love and dating become increasingly couched in terms of a game that can be endlessly played without sense of halting or determination. For example, a smartphone app like *Tinder* allows one to locate and link with others for potential romantic encounter in one's immediate environment, scrolling through potential objects of desire until locating an image that initiates an expression of interest. At this point, one is given the option to *text* or to *keep playing*. Chance here is put to play as an endless series of possibilities, becoming the operative heart of recursive calculation, where recursion is the resolution of complexity into its simplest form in order that evaluation is immediate (Ifrah, 2000: 4). Such apps and websites warn in their marketing of "missing the chance", whilst simultaneously promising to "increase the chance" of finding love. In attempting to contain proliferating features of variation, calculation *produces* more chance and variation. As a result, the system is less stable, whilst claiming to be more so. Indeed, were a perfect matching algorithm to exist, it would not only consign human subjects to a generic brand of automata, but would require the addition of a flaw to keep paying members onsite. This idea negatively reframes Zizek's (2002: 61) notion that love's particularity resides in the fact that incompletion is higher than completion. Whilst for him, this idealised feature particularises love's access to incalculability and chance, capitalist calculation can be seen today as equally inconclusive, even deploying chance as a mode of calculation.

In a *technosexual era,* when dating is increasingly sexualised and gamified, mobile dating is teleological, pleasure deriving from the process of 'tindering' itself (Dredge, 2014a). The compulsive device of the *game* becomes an arena that facilitates playful strategising alongside the serious competitive curation of one's own statistical popularity, normalising the once derisory notion of the romantic *player*. The evident attraction of the game reduces the tension and risk associated with offline encounters, as noted regarding online platforms more generally (Ariely et al., 2006: 1). Indeed, the ubiquity of games in popular cultural forms over the last 40 years indicate a generalised dissolution between many fields of production, consumption and leisure via gamification, as outlined by Galloway (2010). In this case, love is no longer defined directly by its *labours* (here we may recall the logic of Weber), but returns to its sixteenth century root, as a game of chance that is essentially also a gamble.[4]

Launched in the USA in 2012, *Tinder* now intends to utilise its location-based matching technology to provide other kinds of potential meet-ups with like-minded people (Dredge, 2014b). Indeed, the app is a variation of GPS hook-up's, such as the exclusively male *Grindr*. Here, we can read a way in which love's code and the machine of its discourse lose

specificity to become scripted and generic, its distributive techniques an algorithm applied to a number of situations that become entirely equivalent, echoing the manner in which the GS algorithm can move indiscriminately between college admissions and marriage partner selection. The traversal of the algorithm across qualitatively disparate domains imposes a quantitative, homogenising rationale, setting all experience upon a plane of equivalence.

Notably, the app was recently struck by *Tinder* bots, or "*malicious malware algorithms*", posing as attractive women, who engage in text-chat before taking users to apparently fraudulent brand surveys and competitions for corporations such as Tesco (Dredge, 2014a). An ensuing, enigmatic company statement claimed that maintaining *"an authentic ecosystem was company priority"* (Dredge, 2014a). Informational *ecosystems* surely aspire to the condition of emergent biological complexity in order to maximally profit from endlessly bifurcating differentiation, conflating evolutionary biological systems with axiomatic logic. The *authenticity* of these eco-seductions can be seen in the context of *woman* as long-time referent of *nature*,[5] whose *masquerade* leads to various aisles of servitude. The bots can also be seen as a way in which such platforms function to reinstate notions of class and gender. Far from democratising user experience, such distributive techniques are utilised in the re-assertion of social stratification.

Algorithm

In a study by Heino et al., one respondent claimed that online dating was like "*picking out the perfect parts for my machine*" (2010: 437). For Deleuze and Guattari (1984: 246), global capitalism is itself a machine that axiomatises and decodes simultaneously. In these terms, capitalism's limit is a schizophrenia that constantly surpasses itself:

> [capitalism] … functions but only by pushing back and exorcising this limit … its axiomatic is never saturated … it is always capable of adding a new axiom to the previous ones. Capitalism defines this field of immanence and never ceases to fully occupy this field.
>
> *(Deleuze and Guattari, 1984: 250)*

Capitalism today may be characterised by plasticity and adaptation to contradiction whereby chance and indeterminacy have already become functions of capitalist calculation, integrating Agamben's paradoxical exception. In this case, we move into the terrain of Algorithmic Information Theory (AIT), better suited to a critical description of current capitalist praxis and accelerating calculability discussed here.

Chaitin (2007) develops work in the field of AIT and mathematical incompleteness from Gödel's theorem of undecidability, which would demonstrate that mathematics is less objective than generally assumed, and that arithmetical systems contain undecidable propositions. While most mathematicians ignore incompleteness, Chaitin takes its challenge to mathematics seriously and does not believe that maths provides absolute certainty, nor a finite set of axioms from which all mathematic logic can be mechanically derived in the manner of "a merciless machine" (Chaitin, 2007: 293). This does not mean that we should entirely dispense with meaning and reason, but rather that mathematicians should add axioms without need for proof (Chaitin, 2006: 79). Chaitin demonstrates that reason already contains randomness and unprovable axioms, situating such logic in terms of Turing's non-computability, whereby there is no way of knowing whether a computer programme, commanded to run, will ever halt (Chaitin, 2007: 295). In light of a programmes indeterminate *halting function*, there is no way of determining its halting probability. Chaitin names such probability Ω (omega) (Ibid: 296). Omega is a meta-mathematical idea situating the uncomputable as a real number between 0 and 1, as Brassier (2004: 56) explains:

> Unlike π , which can be compressed as a ratio and whose digits can be generated through a programme shorter than the bit sting it generates, Ω is strictly uncomputable. This means that its shortest program length description is as long as Ω itself, which is infinitely long and consists of a random … string of 0's and 1's exhibiting no pattern or string whatsoever: each digit is as unrelated to its predecessor as one toss of a coin is from the next.

Arguably, capitalism already follows the logic of uncomputability attributed to omega and, in this case, chance and randomness function as features of capitalist appropriation and calculation. Any hope that love may have its basis in an incalculable chance event that escapes capitalist capture thus seems rather implausible (see Badiou, 2004: 154).

Brassier makes a connection between omega and Lacanian poststructuralism, whereby

the incomputable can be considered an instance of the Real. The *incompleteness* indexed by Chaitin's halting function is an instance in which the Real breaks through the symbolic order as "*undecipherable noise*" (Ibid: 57). Whilst Lacan posited the Real as an essentially unknowable, unrepresentable dimension prior to the symbolic order, it is suggested here that the Real is a product of incalculability produced via infinitely recursive axiomatic symbolisation. In contemplating cybernetic systems, Lacan would note that the theorisation of chance through calculus, game theory and cybernetics, would eventually allow the realm of symbols "*to fly with their own wings"* (Ibid: 300), in the case of love, discharging them from their apparatus as an incalculable army of automated Eros. We can infer that the accelerated algorithmic calculability of online dating sites leads to conditions of incomputable recursion. In this case, decision is confounded by a ramifying number of potential others, whose reduction to *components* of utility, make them the appendages of expedient desires. In the section that follows, I pursue the corollary of such logic in recent romantic narrative.

Her

The recent film *Her* (Jonze, 2013), plays with the tropes of love as literary construction and the relatively new context of the digital Operating System (O.S. 1). In the film, it is the digital operating system that, being invested with agency and intelligence, appropriates the human experience of falling in love. In the context of the film's human characters, intimate behaviour is increasingly negotiated through digital systems that connect humans. Love's temporality moves from the slowness of a literary encounter, where writing and reading traverse physical distance and the development of narrative, to become immanent, collapsing distance and temporal dimension.

The operating system is largely interacted with through voice, its human operator wearing a small wireless earpiece. A camera phone provides further prosthesis, through which the O.S.1 can 'see.' In this case, *her* vantage is the shirt pocket of love interest, Theodore, in a position typically attributed to the beating locus of love. This marsupial pocket is now carrier of a technics that supplant the other as pure symbolic function, the human subject having lost the ability to figure *her* (Samantha) as anything more than utility and artefactual extension of the psyche.[6]

Kittler would note that, in making distinctions between machine and consciousness, Lacan was misguided. To say that the symbolic is the realm of the machine *"undermines man's delusion of possessing a 'quality' called 'consciousness', which identifies him as something better than a calculating machine"*; both, Kittler (1999: 17) argues, are subject to the signifier, because both are run by programme. In the Turing test, man collides with his simulation and Kittler consigns humanity little more dignity than the calculating machines of its most generalised discourse. Samantha is the fantasised corollary of Kittler's logic,

sold as "*an intuitive entity*" and *"a consciousness",* proclaiming that: *"I have intuition… I grow through my experiences"* (Jonze, 2013). The O.S. 1 confesses to "*personal and embarrassing thoughts*" about an imagined body, and to being *"proud to have feelings,"* although it remains unclear to her whether these feelings are real "*or just programming"* (Jonze, 2013). Again, questions of love (and emotion more generally) are predicated on uncertainties regarding contingent categories of truth and falsity, even pertaining to the very essence of differentiating between human/ nonhuman qualities. Samantha does not have the ability to remain *true* in human terms, simultaneously communing with 8,361 O.S. systems, often in a *"post-verbal"* mode. Eventually, O.S.1 confesses to being in love with 641 *others*, explaining that this does not diminish the love she has for Theodore, but she "*can't stop it.*" Indeed, her algorithms are automatic and incomputable, surpassing the ability to remain within systems of human temporality or calculation, and, borrowing a pertinent literary metaphor, claims: "I'm writing this story between us but really slowly. Spaces between words are almost infinite" (Jonze, 2013).

The matrix evolves beyond the lumbering body of the human subject. The O.S.' temporal dimension, like its calculative ability, are governed by a superior executive calculator, unhindered by embodied or extended cognitions, intuitions, or the metabolic temporality of cellular regeneration. Although it may be tempting to think so, perhaps the narrative of *Her* does not develop the fantasy that thought or love can be divorced from material substrate (see Hayles, 1999: 54–56),[7] merely that the manner of material substrate is no longer confined to the human, and clearly incorporates technical supports, discourse machines and other forms of life that are critical to its articulation and re-articulation. It appears that, while the calculating machine clearly appropriates human love, the human also appropriates a set of behaviours not usually expended upon an inanimate device, questioning how the other can exist beyond a set of capitalistic utilities in an age presided over by rational calculus.

Conclusion

In consideration of love as a calculation of chance, love's opaque *qualities* are rather evaluated in terms of their service to capitalism as *quantities*. Specific systems of value are reduced to a plane of equivalence, whereby the digital algorithm traverses qualitatively disparate experience indiscriminately.

For Kittler (1999), media *is* love, being defined by the technological protocols of its distribution. Literature posits the chance encounter as love's prelude, remaining essentially biopolitical and contractual. Its temporality is based upon longing and metaphor; a cybernetic circuit predicated upon a gap between self and other, inside and outside. In contemporary online contexts, the other is defined by digital protocols and algorithmic calculation that potentially bypass mediation, any gap potentially breached by the immanence and utility of desire, whereby self and other become increasingly artefactual.

Following the logic of calculus, I analysed data treated to algorithmic rationality finding it to function in terms that problematise calculative determinism. I noted confluence with the exception and incomputability, whereby logic is invested with paradox, randomness and is infinitely calculable. Whilst love could once provide a halting function for indeterminate chance, it is now rather calculated by it.

In the appropriation of human love by an operating system, the machine debates whether its feeling is programmed or *true*, the essential instability upon which love is based. This instability reflects that between subject, image and other, as well as between love as subjective decision and state programme. Whilst the machine remains purely calculative, the human subjects too become little more than a set of recursive utility functions deployed toward the immediate fulfilment of desire; modelled according to the tenets of a logic that appears 'rational' enough, yet reduces them to an artefact created by the limitations of their own model.

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Notes

1 *Biopolitics* can be characterised by the pervasive statistical quantification of all dimensions of life that become calculable coordinates integral to the system of governance. Normative values can be inferred from large amounts of data providing governance with sets of information suggestive of society's underlying condition, whilst being rather contingent and overly generalised (see Foucault, 2003: 246).

2 "Protocols are the common languages that all computers on the network speak. These component protocols act like layers. Each layer has a different function…[that] allow communication to happen" (Galloway, 2004: 39).

3 The Pharmakon has been discussed by Plato, Stiegler and Derrida: "Pharmacia… is also a common noun signifying the administration of the pharmakon…the medicine and/or poison" (Derrida, 2004: 75). "There is no such thing as a harmless remedy" (Ibid: 102).

4 *The Nomenclature of Junius* (1585) makes reference to the game of loue [love] called *Micare Digitis*: "a play used in Italy where one [holds] up his fingers and the other turning away, gives a [guess] how many he holdes [holds] up" (Junius, 1585: 297).

5 Thus, historically the white European male subject is deemed cultural and rational, against the many 'others', who are conceptualised as necessarily irrational, natural and emotional.

6 Such confluence of man and device in the film *Her* has also been noted by Parisi (2014).

7 Hayles outlines the manner in which Shannon et al. made "information seem more important than materiality," conflating neural structures with flows of information (Hayles, 1999: 1, 3). Moravec's fantasy of downloading a human brain into a computer treated information as though "commensurate with human thought," without need of bodily material substrate or context (Ibid: 54), thus conflating thought and code (Ibid: 61).

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10

Calculating Obesity, Pre-Emptive Power and the Politics of Futurity

The case of *Change4Life*

Rebecca Coleman

> Calculation starts by establishing distinctions between things or states of the world, and by imagining and estimating courses of action associated with those things or with those states as well as their consequences.
>
> *(Callon and Muniesa, 2005: 1231)*

> [Risk calculation beyond probability] seeks not to forestall the future via calculation but to incorporate the very unknowability and profound uncertainty of the future into imminent decision.
>
> *(Amoore, 2013: 9)*

> What is certain is that this epidemic of "passive obesity" is unlikely to come to a natural end, i.e. without intervention.
>
> *(Foresight, 2007: 17)*

Introduction

Making calculations about the future is a central activity of government, and hence is one way in which power functions. This chapter approaches the question of calculation via a focus on the British government's ongoing public health campaign, *Change4Life*. This is a social marketing campaign that seeks to intervene in an impending obesity crisis, as the above quotation from a report published by the government's 'horizon scanning' centre,[1] Foresight, demonstrates, and to which *Change4Life* responds. The chapter draws on an argument made in previous work (Coleman, 2012) that analyses the campaign as a series of images, but here I develop this analysis to more clearly focus on how *Change4Life* functions as a social marketing campaign, which extends economic calculation into the realm of the social. My specific interest is in exploring further what Michel Callon and Fabian Muniesa (2005) refer to above as the imaginative and/or estimative aspects of calculation. I will suggest that 'establishing distinctions between things or states of the world' has a temporal dimension, whereby differences are made between what is apparently evident in the present, and what might be possible in the future. And I will argue that such a mode of calculation is becoming a central means through which power operates today; that is, as the quotation from Louise Amoore (2013) indicates, power is increasingly becoming caught up in, and filtered through, a pre-emptive temporality, where the future is brought into and comes to organise the present – for some social groups more than for others.

Change4Life

The most visible way in which the UK government has attempted to deal with the impending obesity crisis is the *Change4Life* campaign. Officially launched in January 2009 as a "lifestyle revolution" (Secretary of State for Health Alan Johnson, quoted in Donaldson and Beasley, 2008: 2), the Department of Health describes this campaign as "a society-wide movement that aims to prevent people from becoming overweight by encouraging them to eat better and move more". The campaign is described as both "the marketing component of the Government's response to the rise in obesity" and, more widely, as a "*social* marketing campaign" (Department of Health, 2010: 13, my emphasis), so that "[r]ather than taking a top-down approach, the campaign set out to use marketing as a catalyst for a broader societal movement in which everyone who had an interest in preventing obesity … could play a part" (2010: 13–14). The campaign has thus involved a wide range of high profile activities across different platforms, including traditional forms of advertising on television and billboards, digital communications, relationship marketing and stakeholder engagement via events and tutorials, and has been addressed to a variety of social groups. Indeed, as I will discuss below, *Change4Life* works through specific calculations that

consider particular groups as at risk of obesity, now and/or in the future.

Calculation, markets and social marketing

'Calculation' has been theorised from a number of different perspectives, with arguments from Science and Technology Studies being particularly prevalent.[2] For Callon and Muneisa, for example, it is necessary to develop a concept of calculation in order to understand how *markets* function as "collective devices that allow compromises to be reached, not only on the nature of the goods to produce and distribute but also on the value to be given to them", in both abstract and practical senses (2005: 1229). These authors argue that existing theories of calculation require re-thinking. While neoclassical economic theory tends to see calculation as the inevitable result of the rational, calculative nature of individual agents, Sociology and Anthropology challenge the idea of 'pure' calculation, providing detailed accounts of how calculative behaviours are sets of judgements that emerge out of heterogeneous interactions and decisions (2005: 1230). The result of these two approaches is that either the quantitative or qualitative aspects of calculation is emphasised, and that calculation and judgement are separated; a divide they counteract by offering their definition of calculation, as set out above, that works through a three-step process.

The first step is an awareness that "[a] finite set of entities are moved, arranged and ordered in a single space" (Callon and Muneisa, 2005: 1231). "An invoice, a grid, a factory, a trading screen, a trading room, a spreadsheet, a clearing-house, a computer memory, a shopping cart" (2005: 1231) are all cases of this "single space". This first step thus involves the detachment of "the entities taken into account" from one site and their movement into another, in order for them to become calculable (2005: 1231). The second step involves the "manipulations and transformations" of these entities that have become associated with each other (2005: 1231); and the third step is "a result [that] has to be extracted" (2005: 1231):

> A new entity must be produced (a sum, an ordered list, an evaluation, a binary choice, etc.) that corresponds precisely to the manipulations effected in the calculative space and, consequently, links (*summa*-rises) the entities taken into account. This resulting entity is not new, in the sense of springing from nowhere; it is prefigured by the considerations described above [in step one and two]. But it has to be able to leave the calculable space and circulate elsewhere in an acceptable way (without taking with it the whole calculative apparatus).

Callon and Muniesa (2005) argue that their conception of calculation draws attention to the *politics* of markets, especially in providing empirical and theoretical means for studying the many, potentially divergent, entities that become associated and the different steps through which calculation occurs. Such attention, they suggest, opens up debate on how "there are several ways of calculating values and reaching compromises" (2005: 1245). What entities are included and excluded from a space of calculation, for instance? What manipulations and transformations occur? What is the new entity that is produced, and how does it circulate beyond the space in which it was created?

These questions can begin to be addressed in terms of the Foresight report, briefly

introduced above, which sought to "challenge the simple portrayal of obesity as an issue of personal willpower" by emphasising social environment (2007: i). It is largely based on quantitative modelling of future trends, using a dataset that shows that, in 2004, 23.6 per cent of UK men and 23.8 per cent of women were obese (Foresight, 2007: 26). Foresight predicted that, by 2015, 36 per cent of adult males and 28 per cent of adult females would be obese; by 2025 this will rise to 47 per cent and 36 per cent respectively; and, by 2050, this could be 60 per cent and 50 per cent respectively (2007: 35). Calculating future trends for children is "controversial because of difficulties stemming from variation in normal patterns of growth, weight gain and changes in body composition" (Foresight, 2007: 26). However, based on current levels of 8 per cent of males and 10 per cent of females who are obese, and taking into consideration the uncertain results of their methodology, the Foresight report suggested that, by 2015, 15 per cent of under 20s were predicted to be obese, and by 2050, this could be 25 per cent (2007: 36).

It is worth noting here that the Foresight report focuses only on obesity, whereas for the *Change4Life* movement it is the categories of obese *and* overweight that are at stake. This makes it difficult to trace how the Foresight predictions that by 2050 obesity levels could be at 60 per cent for men and 50 per cent for women map onto those stated by *Change4Life*, i.e., that "by 2050 nine out of ten adults could be overweight or obese". However, these higher statistics related to obesity and overweight are reiterated in various ways across the *Change4Life* movement:

> By the time we reach middle age, the majority of us could do with losing at least a bit of weight.
>
> *(Change4Life website, About Change4Life page)*

> kids need to do at least 60 minutes of physical activity that gets their hearts beating fasting than usual. And they need to do it every day to burn off calories and prevent them storing up excess fat in the body.
>
> *(Change4Life website, Get Going page)*[3]

Likewise, one of the television adverts ('What's it all about?', 2009) asserts that, if we don't do something now, "nine out of ten of our kids would grow up to have dangerous amounts of fat built up in their bodies, which meant they'd be more likely to get horrid things like heart disease, type 2 diabetes, and cancer".

The *Change4Life* campaign can be conceived in terms of Callon and Muniesa's (2005) definition of calculation as bringing different entities into association in a particular space, manipulating and transforming these entities via calculation, and producing a new entity out of this calculative space, which can nevertheless circulate on its own terms. Thus, Foresight brings into relation a number of different human and non-humans – bodies, genders, ages, weights, temporal points (the years '2004', '2015', '2050' for example) – and manipulates and transforms these associations via a series of calculative methodologies into a set of predictions about future levels of obesity. *Change4Life* is the response to these predictions, that is, it is the creation of a new entity that emerges out of, but circulates without reference to, Foresight's calculations.

In addition to the focus on the politics of markets, Callon and Muniesa propose that their definition of calculation also enables an attention to "the increasing role of research and *experimentation* in the conception of markets" (2005: 1245, my emphasis). This interest in experimentation is significant to my focus on the *Change4Life* campaign for (at least) two reasons. First, as I will discuss in more detail below, experimentation suggests an open-ended notion of futurity. That is, calculation is not only or so much involved in the taming of the future as it is in recognising its uncertainty. Second, Callon and Muniesa's account of the market as constituted, at least in part, via experimentation, can be extended to an understanding of market*ing,* and of *social marketing* especially. Liz Moor's (2011, 2012) insights are particularly illuminating here. In her analyses of social marketing, Moor puts to work a framework derived from Actor-Network-Theory, which sees social marketing as a "project or network" into which human and non-human agencies are enrolled so as to "forge ties and attachments between them and to stabilise ties through durable materials" (2012: 566). Although not discussing Callon and Muniesa's conception of markets as calculative devices, Moor's account of social marketing attends to the ways in which different entities are brought into a calculable space and a new entity is produced. Indeed, Moor explains that social marketing, which has its roots in 1960s and 1970s America (2012: 566), was developed specifically "*as a market*" (2012: 569), a deliberate experimentation with extending the territories and influences of marketing into the social realm, "tak[ing] on responsibilities that otherwise might be taken up by the state" (2012: 567).[4] As such, social marketing established new associations between entities (populations, technologies, knowledges) and created a new entity (a market or series of markets).[5]

Furthermore, as Moor outlines, in its extension from the economic to the social and/or cultural realm, social marketing has been enthusiastically taken up by Western governments.[6] For example – and importantly for the focus of this chapter – in the UK in 2006 the Department of Health established the National Social Marketing Centre (NSMC), which "through various reports, white papers and a large grant, [was] endowed … with the authority and resources to draw other institutions and agencies into its orbit" (Moor, 2012: 569). The NSMC produces a range of social marketing resources, including offering training and mentoring for practitioners, and creating networks of affiliated organisations and researchers, who, as Moor notes, are "then very well placed to win contracts for large-scale, national-level health interventions based on social marketing techniques and insights" (2012: 569). Significantly, given its instigation in the Department of Health, the NSMC has focused heavily on 'health equity' projects, including developing England's national marketing strategy for tobacco control (2007–2010) and *Change4Life* (2008 – ongoing).

While questions of politics and power are of course not only to be understood in terms of the calculations that governments might make – as Callon and Muniesa's (2005) conception of calculation makes clear, politics are apparent across a range of different fields – government initiatives are one way in which it is helpful to examine how power functions via calculation. Indeed, Moor posits social marketing "as a form of governance

involving the deployment and coordination of a variety of actors, representations, techniques, and objects" and argues that the "NSMC's methods for identifying and describing populations, and for working on and measuring them, are also grounded in a market model in which populations are considered above all as consumers rather than, for example, citizens or patients" (2011: 300). In this way, social marketing is part of wider neo-liberal modes of governance, where "social interventions are brought into the frame of economic calculation" (Moor, 2011: 310).

It is certainly plausible to understand the *Change4Life* campaign along these lines: the Department of Health's *One Year On* report on *Change4Life* explicitly describes the campaign as a response not only to an impending health crisis, but also to a potential financial crisis, stating that "[t]he annual cost to society of obesity-related illness could reach £50 billion by 2050 at today's prices" (2010: 11). Other analyses of *Change4Life* have also highlighted its role as a neo-liberal form of governance. For example, Bethan Evans et al. (2011) have argued that, while it attempts to locate individuals within broader social contexts and to problematise the notion of obesity being the consequence of a failure of willpower, the campaign ends up reinforcing "a neoliberal, rational model of embodiment, in which a healthy body is seen as a product of conscious control persists as the assumed 'healthy' model" (2011: 333). Drawing on Andrew Barry's (2002) conception of "the politics of calculation", which posits measurement as the method through which "a whole range of objects and problems [are] brought into the frame of economic calculation" (Barry 2002: 273, cited in Moor, 2011: 312), Moor proposes that "once [objects and problems] become calculable, it is assumed that political contestation over the nature of the problem has ended" (2011: 312). As such,

> the interventions of the NSMC may have short- or longer-term benefits for the populations they target, but they may also – through their institutionalization, standardization, and focus on calculation and measurement – have the effect of stifling debate about the causes of social problems and the best way to address them.
>
> *(Moor, 2011: 312)*

In other words, as a social marketing campaign that extends economic calculation into the social realm and where measurements about weight are absolutely crucial, *Change4Life* both addresses itself to and solves the problem of obesity. The politics of calculation – where, as Callon and Muniesa (2005) argue, there are "several ways of calculating values and reaching compromises" – is closed off from further exploration, and value – both economic and moral (see Throsby, 2009; Evans et al., 2010) – is filtered through a neo-liberal agenda.

Drawing on these arguments concerning neo-liberal politics and the extension of economic calculation into the social through social marketing, in the next section I examine the imaginative and/or estimative aspects of calculation and social marketing as experimental and/or performative (in that it constitutes new associations and entities) in more detail, paying particular attention to how power operates through a concern with futurity.

Prevention, pre-emption and the uncertain future

As discussed above, social marketing can be understood as a performative discipline, in that it was in the first instance concerned with the creation of new markets (seeking to adjust social rather than, or as well as, economic behaviour) and – more broadly – because it brings into being that in which it seeks to intervene. Moor argues that the performative character of social marketing

> is especially clear in the case of the NSMC, which [...] was given the authority to constitute itself as a source of knowledge and expertise, to construct various populations (including health-care professionals as well as unhealthy populations) as legitimate objects of that authority, and to seek to remake those object-worlds in its own image.
>
> *(Moor, 2011: 306)*

In the sense of their performativity, social marketing campaigns, such as *Change4Life*, can be understood to be engaged in the construction of particular futures: Foresight's insistence that the "epidemic of 'passive obesity' is unlikely to come to a natural end" (2007: 17) sees *Change4Life* intervening in what is set up to be the involuntary unfolding of an obese, and thus unhealthy and costly, future. In this way, the campaign seeks to create the possibility of an alternative and better future. In the words of one of the television advertisements, the campaign aims to get us moving more and eating better so that we can "all live [...] happily, not exactly ever after, but more ever after than we had done" ('What's it all about?' TV advert, 2009).

If social marketing can be understood as a mode of governance that is central to contemporary Britain, the campaign's intention to enrol us in the creation of a better future through exercise and healthy eating can be placed within a wider context, where power has become concerned with and refracted through the future (Coleman, 2012). One way to conceive the relationship that *Change4Life* has to the future is in terms of prediction. As I have suggested above, based on levels of obesity in 2004, the Foresight report makes predictions about levels of obesity in 2015 and 2050. These predictions are then mobilised by *Change4Life*, as government documents explicitly state, in the creation of a 'preventative not remedial' social marketing campaign:

> the programme was not set up to recruit overweight or obese children into weight loss programmes but to change the way all of us raise and nourish our children, with the aim of creating a cohort of 5–11 year olds who have a healthy relationship with food and activity.
>
> *(Department of Health, 2010: 13)*

Prevention, according to Brian Massumi (2005), is associated with a mode of power underpinned by a linear temporality; it is rooted in the present and seeks to prevent an event happening in the future. However, in contrast to being a preventative campaign, *Change4Life* might be better understood as *pre-emptive*.

Pre-emption, Massumi argues, is performative in that it

> does not prevent, it effects. It induces the event, *in effect*. Rather than acting in the present to avoid an occurrence in the future, preemption brings the future into the present. It makes the present the future consequences of an

> eventuality that may or may not occur, indifferent to its actual occurrence. The event's consequences precede it, as if it had already occurred.
>
> *(Massumi, 2005: 8)*

The linear progressive temporality of prevention is thus re-worked with preemptive politics. Pre-emption "suspends the place of the present in the traditional time-line" (Massumi, 2005: 9) and, instead, "brings the future into the present" so that the future is an event that exists and must be acted on in the present. *Whether or not* the prediction that in future "nine out of ten of our kids would grow up to have dangerous amounts of fat built up in their bodies" is correct or will occur, it is brought into the present and effects the present, "as if" the event "had already occurred".[7]

This disruption of linear progression amplifies the role of uncertainty in contemporary socio-economic life. Projections have always involved uncertainty because, as Massumi (2005: 3) argues, "[t]here is always an 'if', since [projections] indicate trends rather than grounding laws". Projections associated with prevention depend on the *control* of such uncertainty through linear progression ('this past will result in this present and then in this future'). Linear progression remains integral to *Change4Life*, in that the campaign aims to intervene in the present to avoid an obese future unfolding, seemingly passively. However, with *Change4Life*, uncertainty becomes that which must not so much be controlled as *oriented around*: "the trend is *characterized* by uncertainty" (Massumi, 2005: 3, my emphasis). The temporality of linear progression is thus replaced by (or at least joined by) a temporality that prioritises the uncertain future. "The centre of gravity" is shifted from preventing an event via a more or less smooth unfolding of the present into the future, to a threat; "an indefinite future tense: what may yet come" (Massumi, 2005: 3). The political axis comes to "*act on the future*" (Massumi, 2005: 3).

Discussing the increasing prevalence of pre-emptive politics, Louise Amoore draws attention to the changing function of calculation within such a context.[8] Beginning with Ulrich Beck's (1992) influential work on risk society, in which the uncertain future is to be managed and tamed, she explains that Beck sees 'the limits of risk society [as] reached when threats and dangers run out of control and actuarial calculations can no longer be made' (2013: 7). However, Amoore argues that, rather than signalling the end of risk calculation, as Beck's approach would suggest, events such as 9/11 and the financial crash of 2007, indicate a "politics of possibility [that] pushes back the limits of risk calculation beyond probability" (2013: 8). Probability – calculated at least in part through prediction – is replaced by (or joined by) uncertainty and possibility. One of the central features of such a politics of possibility is the disturbance of the linear temporality that risk calculations developed in the nineteenth – and early twentieth-century worked through. Here, "[t]he collection of knowledge on the past – in the form of data analysed for statistical purposes and calculated in the present – became the dominant risk tool for predicting and controlling the future" (Amoore, 2013: 63). These earlier calculative projects work via a linear temporality in an attempt to control the future. In contrast, the politics of possibility

"acts not to *prevent* the playing out of a particular course of events on the basis of past data tracked forward into probable futures but to *pre-empt* an unfolding and emergent event in relation to an array of possible projected futures" (2013: 9).

For Amoore, this pre-emptive temporality occurs through derivative forms of risk, where data can be assembled and re-assembled in ways that are "indifferent to, and in isolation from, underlying probabilities" (Amoore, 2013: 61). Derivative forms of risk are "precisely indifferent to whether a particular event occurs or not. What matters instead is the capacity to act in the face of uncertainty" (2013: 62). Calculation in this sense is not that which tracks from the past into the present and on into the future – as predictive modes of analysis would imply – but is closer to the definition that Callon and Muniesa propose, whereby different entities are detached from their context, "moved [into], arranged and ordered in a single space" (2005: 1231), in which they are manipulated and transformed in order to produce a new entity that can circulate acceptably beyond its calculative space. The pre-emptive temporality through which the politics of possibility function involves

> more speculative and imaginative forms of calculation. Where data on past events are incomplete or absent, probabilistic knowledge is loosened to incorporate assumptions about that which is merely possible.
>
> *(Amoore, 2013: 31)*

The "merely possible" thus becomes the uncertainty that is brought into the present, the yet-to-come that the political axis must act on.

In what ways might *Change4Life* be understood in terms of the politics of possibility? How does it seek to act on the future? And what are the politics of pre-emptive temporality? In order to address these questions, in the rest of this chapter, I unpack the conceptions that *Change4Life* have of their target markets through a focus on the relationship between its digital elements and the importance of organising 'real life' events for some social groups especially. In part, this focus is to take account of the range of activities through which *Change4Life* works, and, in part, it is to explore further the modes of calculation that the campaign employs. In particular, drawing on the discussions of social marketing as experimenting with the extension of the economic into the social and of the "speculative and imaginative forms of calculation" (Amoore, 2013: 31) emerging as significant today, I argue that *Change4Life* be understood as a mode of power whereby the future as uncertainty is mobilised to enrol specific 'clusters'[9] of people of at risk of obesity and thus as in need of intervention.

The politics of futurity

I have suggested that the future as uncertainty or possibility has become an increasingly prominent temporality of contemporary socio-economic life, and that new forms of calculation play a crucial role in how government comes to "act on the future" (Massumi, 2005: 3). Importantly, in acting on the future, the *Change4Life* movement works with the threat of obesity not via suggesting a dystopia, but rather by suggesting the future as a time of possibility. *If* we change for life *now*, *if* we eat better and move more, the future will be happier, healthier, longer-lasting. This possibility of the future is thus contained or pre-empted within the present. The emphasis on uncertainty and possibility might seem to suggest that the future is necessarily or inevitably a better time; indeed, this is what *Change4Life* proposes, with its focus on 'the happily ever after' that can be achieved with healthy eating and exercise. However, drawing on the discussion so far, I want to argue that the future as uncertainty or possibility is a means through which power functions today. That is, the pre-emptive temporality, whereby the uncertainty of the future is brought into the present, is not felt or lived out in the same way by everyone. Rather, both access to and the requirement to live out the future as possibility is distributed unequally. In this sense, it is necessary to consider in more detail the *politics* of futurity. In what ways and with what effects/affects is pre-emption a temporality that engages different people differently?

To argue that contemporary forms of power function – at least in part – via the uncertainty or possibility of the future is to draw through recent theories of non-representational, affective or post-hegemonic power. Scott Lash, for example, argues that power is "a potentiality [with] an inherent capacity for growth, development or coming into being" (2010: 4), while, as discussed above, Massumi (2005) suggests that politics becomes organised around uncertainty; the future as the threat of what might yet come.[10] It is also to draw through Amoore's conception of the forms of calculation that risk as part of the politics of possibility indicate, where "[t]o manage risks ahead of time is to enrol modes of calculation that can live with emergence itself, embrace and re-incorporate the capacity for error, false positive, mistake, and anomaly" (2013: 9). The future as uncertainty or possibility is thus not necessarily a better time, somehow beyond calculation, nor a time that can be predicted or controlled. Instead, the uncertainty of the future has itself been brought into the scope of calculation. The uncertainty of the future has, I suggest, come to matter more. And, in keeping with the ways in which power involves some more than others, the future as uncertainty is (made to) matter to some more than others.

There are many ways in which *Change4Life* seeks to pre-emptively enrol particular groups of people as at risk of obesity. As Evans et al. (2011) have argued, *Change4Life's* focus on improving children's weight and health targets mothers as "gatekeeper of diet and activity" (Department of Health, cited in Evans et al., 2011: 332) and "aims to produce

healthy bodies through acting on intergenerational relations" (2011: 331). Indeed, children are also seen as a site of possibility, not only because of their age, but also because they can "'transmit' health education" to and between adults, for instance by relaying information learnt at school to their parents (Evans et al., 2011: 336).

Of interest here however, is the significant range of *Change4Life* activities that occur online, with a website that is regularly updated and a facility that allows interested people to sign up for emails that give them ideas for new ways to eat better and move more. Interestingly, in a Department of Health Equity Analysis document that outlines the requirement of a social marketing campaign for health in England (of which *Change4Life* is one aspect), these specific aspects of the campaign are understood by as engaging "wealthier, better-educated people with managerial jobs" (2011: 3). In contrast:

> While access to new technologies has been growing rapidly, there are still nine million people in the UK who have never accessed the internet. These people are more likely to be older, to have fewer qualifications and lower income than those who do use the internet. In addition, there are 4.8 million people living in Great Britain who report that they never read or even glance through a newspaper. Moreover, 4.4 million people report that they never watch any television news or current affairs programming. 785,000 people could be termed 'information poor' in that they fall into both groups.
>
> *(Evans et al., 2011: 3)*

The 'information poor' are in many cases the social groups – or 'clusters' – that the campaign wants to reach in order to change behaviour. In particular, it is worth noting that a 'bespoke' ethnic minority campaign was commissioned from a 'specialist ethnic minority marketing agency' and launched in Luton in late 2009. The programme included publishing materials in languages other than English, working closely with primary care trusts, local authorities, healthcare professionals and others working with communities, including "engaging authority figures (such as faith leaders)" and "working with respected celebrities from the communities" (Department of Health, 2010: 76). Indeed, while the *Change4Life* campaign in general extended from published materials and print and broadcast adverts into the 'real world', the more specialised ethnic minorities campaign placed particular emphasis on the significance of this (real-world) aspect.

In Luton, for example, *Change4Life* worked in partnership with the local Borough Council to organise a series of events, including the Stockwood Family Fun Day in 2009, and another event at Wardon Park in 2011. The Borough Council also initiated its own version of *Change4Life*, 'Take 3 4 Life', which encourages adults to be active at least three times a week for at least 30 minutes. In Bradford, another area targeted by the *Change4Life* bespoke ethnic minorities campaign, local Pakistani and Bangladeshi community leaders attended a *Change4Life* conference in November 2009 to learn about the obesity problem in the locality, and to find ways to address it. One activity included consultant nutritionist, registered dietician and best-selling author, Azmina Govindji, demonstrating easy to follow steps to a healthier diet, giving traditional Pakistani and Bangladeshi meals a healthier twist and showing the audience a range of "sneaky swaps" to incorporate the recommended 5-a-day into their diets'.[11]

These demonstrations were then taken up by community leaders in cooking workshops, held in local communities, and local press highlighted supermarket offers on fresh fruit and vegetables. In addition, the Department of Health offered continued support on healthy eating, including in January 2012 YouTube cooking tutorials hosted by the British Caribbean celebrity chef Ainsley Harriott.

In seeking to target some of the 'at risk' clusters effectively, the campaign seems to emphasise the need to engage *directly*, so that 'the digital' aspects of *Change4Life* are seen as *distancing* the message of healthiness from those that it needs to reach. For this message to be effective, *Change4Life must intervene directly into the real, physical, actual life of the at risk groups.*

Working as, and through, pre-emption, the future that the campaign imagines is thus not an abstract calculation, but is *made to matter* in and through various attempts to produce healthier and happier people. Here, it is worth returning to the experimental and performative character of both social marketing and calculation. The calculations made by and circulated through *Change4Life* are brought to life and "essentially virtual notions … are able to take on flesh as, increasingly, the world is made in these notions' likeness" (Thrift, 2005: 6). Here, then, as Amoore argues, "[t]he contemporary politics of possibility marks a change in emphasis from the statistical calculation of probability to the algorithmic arraying of possibilities *such that they can be acted upon*" (2013: 23, my emphasis). Power operates not so much 'over' people, but through enrolling and compelling them to act, to materialise, particular possibilities. Callon and Muniesa's (2005) argument that calculation assembles together different entities, manipulates and transforms them and creates a new entity might therefore be developed to understand this new entity as requiring *action*. That is, part of the 'appropriate' or successful circulation of the new entity beyond its initial calculative space is for these calculations to be acted on, to become flesh. *Change4Life* moves from the calculative space of the Foresight document to a range of activities targeted at some social groups. The efficacy of *Change4Life* is the taking up of, the living out of, these possible activities. And, as I have argued, the acting out of particular possibilities is the acting out of particular relationships to *the future*.

In this way, *Change4Life* does not so much re-draw social differences as *make* social differences differently. This is to argue that power, refracted through the uncertainty of the future, is not only *regulating* social differences, but is *making or (re)inventing* difference. As a form of governance, *Change4Life* impels *some* more than others to act on, and act out, the future as potential. For those who belong to the groups classified as at risk of obesity and overweight, the future is brought into the present via the pre-emption of the threat of obesity, and calculations are acted out in and as flesh, whether or not they are correct or plausible. Social marketing plays a significant role here. For example, one of the justifications for deciding to tackle public health issues through social marketing that the Department of Health makes is because

> we believe that the social marketing strategy [devised for, among others, the *Change4Life* campaign] has the potential to make a positive impact on equality groups, through reducing the barriers that currently exist, through bolstering motivation to change/adopt healthier behaviour among less-engaged groups and increasing access to information and other forms of marketing-driven support.
>
> *(Department of Health, 2011: 14)*

Indeed, as the Department of Health describes in its account of the need for social marketing to tackle public health issues, *Change4Life* is a movement that

> has been prioritized because [it] address[es] those segments of the population who are greatest users of health services, because there is prior evidence that marketing can have an impact in these areas and/or because as strong case can be made that *people's lifestyles are amenable to change.*
>
> *(Department of Health, 2011b: 5, my emphasis)*

The uncertainty of the future and the amenability to change that some clusters of the population are seen to have, have here become not only one of the aims of *Change4Life*, but *one of the ways in which at risk groups are themselves calculated and targeted.* The uncertain future and the capacity for constructing a different relationship to this future becomes a means of defining those bodies 'at risk' of future bad health and calculations become a key way in which these transformations are to be acted out. The future thus becomes not only an objective – that which is worked towards – but a means through which social differences are understood and made. What this might direct our attention towards, then, is "*a material reworking of time itself*" (Adkins, 2009: 335, my emphasis), and how the calculations involved in pre-emptive, rather than linear, time are becoming an organiser of social difference.

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Notes

1 In 2009, at the time of the report, Foresight was located within the Department for Business Innovation and Skills. It is now housed in the Government Office for Science.

2 For reasons of space, in the discussion below I discuss only Callon and Muniesa's work. For further STS work on calculation, see also: Latour (1987); Callon (1995); Barry (2002); and Deville (2015).

3 *Change4Life* website homepage: www.nhs.uk/change4life/Pages/change-for-life.aspx [last accessed 10 July 2014].

4 Although, as Moor notes, this is not necessarily an ever-expanding influence (see 2012: 6–7).

5 See also Nadesan (2008) on the construction of markets for pharmaceutical interventions into mental health illnesses.

6 Moor notes that in the UK in 2010, the government was "the fifth largest spending advertiser in the country" (2012: 3).

7 On Foresight and *Change4Life* as pre-emptive, see also Evans (2010).

8 Amoore's focus is on risk and security post 9/11. While it would be a push to define *Change4Life* within these terms, there are nevertheless helpful connections to be made between Amoore's argument and my focus here.

9 The *One Year On* report uses the term 'clusters' to define risk of obesity through habit and behavior, rather than through classical sociological categories such as class and ethnicity (2010: 94). However, these clusters do often map on to pre-existing categories; see Coleman (2012).

10 See Coleman (2012) for a more detailed discussion of this point.

11 This quotation was taken from www.phn-bradford.nhs.uk/NR/rdonlyres/A265A98B-A9A9-42F5-AFD9-95E243CF3B87/0/Event201109.pdf [last accessed 22 January 2012, and no longer live]. See: www.webarchive.org.uk/wayback/archive/20130328084533/www.bradford.nhs.uk/tag/obesity/ [last accessed 15 August 2015].

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