ESRC Review: Data and Representation

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Abstract and Keywords

This chapter describes the analyses and results for the ESRC Domain of Data and Representation, guided by the question: “How do we live with and trust the algorithms and data analysis used to shape key features of our lives?” It provides an initial overview of major insights from the literature review and analysis, the Delphi surveys, and workshop discussions about the relevant concepts of data and representation in a digital age. It then focuses on technology, development, and organizations but later emphasizes data issues and, less frequently, policy, information, communication, technology, and research. Fourteen main topics emerged: global and urban culture, governance, Twitter and politics, cybercrime, Google, law and hate speech, big data, science and methods, health, gender, consumer services, ethics and impact, mobile, and social media. The chapter provides brief summaries of publications dealing with three key issues emerging from these topics: data methods, data sources, ethics and impact, and data representation and other domains. The analyses also highlight theory, methods, and approaches in the literature, showing predominantly inductive work, emphasizing reviews, commentary, or secondary data. The main theoretical sources were by far sociology, then psychology and communications and media. The plurality of articles involving research used case studies and various data collection methods. Finally, the chapter discusses future research and scoping questions (e.g., with social impacts; privacy and surveillance; citizens/everyday life; and open data/algorithm transparency/accountability) and research challenges (methods; social theory and social questions; access to data; data literacy; education;, ethics; inequality/exclusion/inclusion/divides; and interdisciplinarity).

Keywords: data analysis, data methods, data representation, data sources, ESRC Review, ethics

Introduction

THIS chapter provides an overview of the analyses of the literature review, the Delphi process, and any relevant workshops for the Data and Representation domain. The chapter first explores the results of the various digital humanities analyses of the literature

and the review of methods and theory, providing examples from specific studies. The chapter then sets out the results of the Delphi Process, concluding with the key questions, topics and challenges identified by the process. These two sets of results are then compared. The last section presents recommendations for areas of future study. As a reminder, the initial ESRC scoping question for this area of work was, “How do we live with and trust the algorithms and data analysis used to shape key features of our lives?”

Initial Comments

The analysis of this domain was very distinct from the other six. Many of the issues and questions here seemed to be “born digital” (Negroponte, 1995; Tapscott, 1999; see also chapter 1). That is, they are questions that can only really be asked in and of a digital age. This was also the area where the questions seemed to fit closest to the issues raised by stakeholders in the various workshop sessions. In the discussion with stakeholders it was the disruptive potential, the social impacts of data and automation, and the need for, or lack of, clear governance of these that came to the fore. Although the questions and issues appear “born digital” in how they are articulated, however, they are not necessarily “new” in that many could be and were asked of the impacts of ICTs over the last 30 years or so. What makes them all very pertinent is the intensification of digitization, (p. 502) the migration of digital into all aspects of everyday life, and the growth of platforms that deliver key social and personal services as well as economic value, but whose use of data and underlying algorithms are not overtly visible. Also of note is the number of publications utilizing geographical data and information systems. This likely reflects the maturity of the field in its use of, and discussions around, data derived from digital media and technologies.

Literature Analysis

Topics

The literature analysis was designed to identify two sets of data. The first is key topics within the existing literature. This allows the comparison with areas of importance identified by the Delphi review. The second is a content analysis of the literature to explore the predominance of specific, theory, methods, and approaches. Table 18.1 lists the 16 most common concepts (2% or more of the cases) identified in the Round 1 literature analysis, with the most frequent being data/datum, news, country, business, government, medium, and consumer. Table 18.2 lists concept pairings.

Table 18.1 Analysis Concepts Ranked

Concepts	**Percent**
Datum	10.4
News	6.7
Country	6.6
Business	6.2
Government	5.7
Medium	4.9
Consumer	4.7
Internet	4.1
Arrow	3.5
Community	3.2
Citizen	3.0
Privacy	2.6
Impact	2.4
Group	2.2
Science	2.2
Development	2.0

Note: Concepts occurring in at least 2% of the cases.

Table 18.2 Concept Pairings—Main and Secondary Concepts

Concepts	Percent	Concepts	Percent	Concepts	Percent
arrow	**5.01**	**datum**	**14.79**	**medium**	**6.98**
change	.67	default	1.30	newspaper	1.93
group	1.02	ecosystem	2.84	penetration	.88
internet	1.02	embodiment	.74	routine	1.82
level	1.23	passport	.39	sentiment	.88
user	1.09	preservation	2.59	tablet	.74
business	**8.80**	publisher	2.59	texture	.74
competence	2.59	repository	3.54	**news**	**9.53**
construct	.77	selfhood	.81	one-off	1.23
manager	1.72	**development**	**2.87**	payment	1.26
partnership	1.54	ecosystem	1.16	quarter	.56
professional	2.17	program	1.72	rank	.95

citizen	**4.28**	**government**	**8.06**	revenue	.91
government	4.28	organization	1.93	story	1.19
community	**4.56**	sector	2.66	tablet	1.12
connection	.95	shift	1.44	television	1.33
planning	1.96	spot	2.03	usage	.98
resident	1.65	**group**	**3.08**	**privacy**	**3.75**
consumer	**6.73**	male	.95	springer	.60
customization	1.51	receptivity	1.16	stakeholder	2.07
delay	.67	reliability	.98	tag	1.09
effect	3.05	**impact**	**3.36**	**science**	**3.05**
enforcement	.88	sector	1.86	war	1.72
tag	.63	surveillance	1.51		
country	**9.36**	**internet**	**5.78**		
fuel	.39	male	.84		

nation	1.26	self-service	.91		
news	2.03	shopping	2.07		
organization	.91	store	1.96		
pollution	.70				
price	.95				
resource	3.12				

Note: **bolded** term is the main concept; the unbolded terms below that and above the line are the related subconcepts.

All the literature collected from both rounds was analyzed using WordStat. WordStat identified 14 topics (Global and urban culture, Governance, Twitter and politics, Cyber-crime, Google, Law and hate speech, Big data, Science and methods, Health, Gender, (p. 503) Consumer services, Ethics and impact, Mobile, and Social media); see Table 18.3. These topics map closely to the concepts identified in the concept analysis. Table 18.4 presents an analysis of the overlap between the two analyses.

Table 18.3 WordStat Analysis of Topics

Topics	Keywords	Eigen-value	Freq	Cases	% Cases
Global and urban culture	GLOBAL; COSMOPOLITAN; CULTUR; URBAN; MEDIAT; LOCAL; MOBIL	8.84	13,334	520	91.2
Governance	PRIVAT; SECTOR; GOVERN; PUBLIC; CITIZEN; ENFORC EUROPEAN; COMMISS; EU; EUROP; HTTP; EGOVERN	2.68	890	138	24.2
Twitter and politics	TWEET; HASHTAG; ELECT; TWITTER; CAMPAIGN	2.31	4039	279	49.0

Cybercrime	WAR; CYBER; ATTACK; WAR-FAR; MILITARI; CYBERATTACK; MORAL; TER-ROR CKING; TRAF	2.20	749	113	19.8
Google	SEARCH; EN-GIN; GOOGL; WEB	1.97	9168	493	86.5
Law and hate speech	SUPRA; REV; SPEECH; AMEND; ID; HATE; LAW; COURT	1.81	7764	406	71.2
Big data	DATA; BIG; AL-GORITHM	1.71	18,512	510	89.5
Science and methods	SCIENC; SCIENTI; SCIENTIST; KNOWLEDG; SOCIAL	1.64	27,358	548	96.1

Health	HEALTH; MEDIC; PATIENT; MEDICIN; LUP-TON; BODI	1.58	6913	410	71.9
Gender	WOMEN; MEN; GENDER; ADULT	1.53	4308	323	56.7
Consumer ser-vices	CONSUM; MARKET; PRODUCT; CUSTOM; SERVIC	1.47	15,804	520	91.3
Ethics and im-pact	ASSESS; IM-PACT; PRIVACI; PIA; ETHIC	1.45	14,039	495	86.8
Mobile	MOBIL; PHONE; DEVIC	1.40	4897	404	70.9

Social media	FACEBOOK; MEDIA; YOUTUB; CONTENT; SITE; PLATFORM; VIDEO; USER; SOCIAL; TWITTER; ONLIN; NETWORK	1.38	50,989	561	98.4

Table 18.4 Comparison between Concepts and WordStat Topics

Concept/Topic	Social media	Science and methods	Global and urban culture	Consumer services	Big data	Ethics and impact	Google	Health	Law and hate speech	Mobile	Gender	Twitter and politics	Governance	Cyber crime
Datum														
News				X										
Country													X	
Business				X										
Government													X	

Medium	X													
Consumer				X					X					X
Internet				X							X			
Arrow														
Community	X													
Citizen			X										X	
Privacy						X								

Impact						X							X
Group	X									X			X
Science		X											
Development		X											

Unlike the other domains, several of the topics identified earlier—global culture, governance, citizens—are not in and of themselves the focus of the current examination. In fact, they represent elements of the other domains such as politics, governance, or health. In examining the domain of “Data and Representation,” we were looking to (p. 504) explore what new or existing research issues sat behind the social science topics. Looking at the use of underlying keywords in each analysis over the period we find an important shift.

As Figure 18.1 shows, in the period 2000–2004, the most frequent concept pairs were fairly general, involving technology (including Internet, information, systems), consumers/people, development (along with country, environment, and world) and organizations (including management and business).[1] By the period 2012–2016 (Figure 18.2), there was much more focus on data issues (not surprisingly), including data, access, use, privacy and protection, and user, and, less frequently, policy, information, communication (p. 505) (p. 506) and government, and reference to technology (Internet, service), as well as research (research, science, project). Data (in the form of “datum”) co-occurred with nearly all of these. So over the 16-year period, the literature clearly changed its focus from general technology (including the Internet) use in a few contexts to a pervasive emphasis on data in a wide variety of contexts.

Figure 18.1 Data and representation 2000–2004: Most frequent concept pairs.

Figure 18.2 Data and representation 2012–2016: Most frequent concept pairs.

Working through the analyses we would argue that the topics in the literature are split between data methods, data sources, and ethical and social impacts. So for data methods we find discussion of science and methods, use of big data, or specific technologies such as Google. In terms of data sources there is discussion of data from social media (e.g., Twitter) and mobile devices. The areas of focus cover the breadth of the other domains in this volume with topics such as: global and urban culture; consumer services; health; law and hate speech; gender; politics; governance; and cybercrime. There are strong themes of governance, ethics and social impact. As we will discuss later this is very similar to the breakdown of research questions and challenges from the Delphi review.

The following sections address: data methods, data sources, ethics and impact, and data representation and other domains. We are not looking here to consider what might (p. 507) be described as the computing or computer science issues underlying the uses and forms of data. Rather we are exploring how these issues intersect with social research questions and methods in regard to the social impacts of digital technologies. As with the other ESRC review chapters that have analyzed a specific domain, the following sections provide examples of literature to develop and highlight the identified themes and issues. These are not intended to be exhaustive discussions of all the literature.

Data methods. As a starting point for the discussion of the uses of data, the literature has a number of examples where researchers have reflected on the use of digital data—often referred to as “big data” (see especially chapters 19 and 20). boyd and Crawford (2012) raise six critical issues regarding the use of “big data” in research, concerning what this data means, who has access, how it is analyzed, and for what purposes:

1. Big data’s role in potentially changing the definition of knowledge.

2. The potential for misleading claims for objectivity and accuracy based on "volume" of data.
(p. 508) **3.** The need to understand that "bigger" data is not necessarily better, in fact "small" data can provide meaningful insights.
4. That big data is not "unbiased" or context free and needs to be analyzed within its context to have meaning.
5. Just because data is easily accessible does not make it ethical to use or analyze that data.
6. Limited access to big data creates a new digital divide.

The authors define big data as a cultural, technological, and scholarly phenomenon that rests on the interplay of technology, analysis and methodology:

> Big Data offers the humanistic disciplines a new way to claim the status of quantitative science and objective method. It makes many more social spaces quantifiable. In reality, working with Big Data is still subjective, and what it quantifies does not necessarily have a closer claim on objective truth—particularly when considering messages from social media sites.
>
> (p. 667)

They go on to argue that

> Interpretation is at the center of data analysis. Regardless of the size of a data, it is subject to limitation and bias. Without those biases and limitations being understood and outlined, misinterpretation is the result. Data analysis is most effective when researchers take account of the complex methodological processes that underlie the analysis of that data.
>
> (p. 668)

Continuing the reflections of methods and technologies that researchers use, Ruppert et al. (2013) examine social science methods in light of digital media and devices increasingly being the "stuff" that rework, mediate, mobilize, and materialize social life. Their article raises questions of how digital devices complicate social sciences' "ways of knowing." As they argue, digital methods are not conducted in laboratories but involve large statistical procedures which rely on interconnected devices. They are also defining and shaping human relations. They note tha:

> When we speak of methods here we mean the specific apparatuses that assemble digital devices and data to 'know' the social and other relations. We are saying that digital devices and the data they generate are both the material of social lives and form part of many of the apparatuses for knowing those lives.
>
> (p. 24)

Considering the way digital devices are entangled with social science research, Ruppert et al. offer nine provocations for digital methods:

1. Much of the data from digital media is about **transactional interactions** of actors (whether human or machine). It logs and measures the complex flows and networks of transactions but may have limited detail on the specific actors. (p. 509) This means that non-individualist and non-human accounts of the social can be examined,
2. We need to be mindful of the **heterogeneity** of actors in networks (Latour, 2010; Latour & Woolgar, 1986) who create, translate and transmit the data—from people to software agents. It is possible that the "human" description of society is replaced by a socio-technical and transactional description.
3. The re-emergence of **visualization** is a key to social analysis. Though many "big data" analyses remain statistical, visualizations have taken up a greater role in the presentation, communication, and analysis of social data.
4. Some digital data are available over **continuous time**. Unlike surveys which are at best temporal snapshots (e.g., in panel surveys) or ethnographic case studies that might contain narrative accounts, many forms of digital data such as social media can be traced over time. That said, many digital data sources do not get archived and so leave no temporal trace.
5. Many digital data sets claim to have **whole populations** rather than samples—in that all users are in the data set. Care needs to be taken here as these are whole populations of their users—or more accurately of their transactions (see provocation 1)—but these may not be representative of relevant whole populations (within an area or activity).
6. Slightly counter-intuitively, these whole populations and integrated data (see 5 and 1) allow for forms of **granularity** in analysis that other methods do not. Individuals can be formed into groups inductively and statistically validated against criteria to offer predicators or identify likely features (e.g., credit risk, re-offending, or cultural taste).
7. There is a potential changing role for **expertise** in data collection. If data is produced as a by-product there is no need for experts to be involved in the design of the tools used in its creation. You may not need a survey design expert, as all your customer data comes from their transactions. As such, non-social science specialists such as computer scientists become more prominent mediators of how and what data are collected. Social science expertise may come in after the fact in the forms of the analysis, critique of the methods, and interpretation and presentation of the results.
8. Data are now generated in complex social spaces that through **mobile and mobilizing** technologies are multi-faceted. You may generate personal data from your mobile device while sitting at work, generating occupational data via your laptop. Data therefore may transcend current institutional boundaries. Many devices actively seek users' involvement in logging and selecting data (e.g., Facebook) and to an extent generate data akin to Mass Observation work of the mid-20th century (Summerfield, 1985), yet on a greater scale and with less structure and obtrusiveness.

9. Given 1 to 8, there is considerable danger of **non-coherence of knowledge creation** as the data sources, their transience, their accessibility, and the availability of digital tools to analyze these makes everyone a potential "knowledge creator." Though this might seem like a democratization of data and knowledge, Rupert, (p. 510) Law and Savage note that this may in fact be an erosion of the processes whereby analyses and knowledge are properly validated. Whatever the balance between these positions, they note that knowledge production may be less coherent in the context of digital data.

They conclude that

> in relation to digital devices, then, we need to get our hands dirty and explore their affordances: how it is that they collect, store and transmit numerical, textual, aural or visual signals; how they work with respect to standard social science techniques such as sampling and comprehensiveness; and how they relate to social and political institutions.
>
> (Ruppert et al., 2013, p. 32)

But of course, digital data are not confined to more quantitative forms. boyd (2015) discusses the way ethnographers can capture ethnographic data when examining teens' everyday life with technology. To do that, she undertook offline participant observation, semi-structured interviews, content analysis and "deep hanging out." One of the main things boyd emphasizes is the need to discuss wider issues and not focus only on technology as context in order to understand how and why teens use digital systems. As implied by Ruppert et al., digital data may be partial and focus on the transactional, and not the person:

> Getting at what teens do and why they do it requires triangulation and perseverance. It requires being embedded in teen culture and talking with teens about their practices. Social media may increase the visibility of certain teen practices, but it does not capture the full story. More often than not, getting at the nuances of teen life in a networked era requires going back to foundational practices.
>
> (p. 95)

As noted previously (Ruppert et al., 2013), another key method and tool in digital research is visualization. Kennedy et al. (2016) highlight methodological and representational concerns and critiques. They argue that data representation through visualizations is often portrayed as objective and is valued as explanation. The visual structuring and presentation of the data increases the persuasiveness of the results, especially by using multiple techniques: showing the data sources, using a "clean" layout, creating order with shapes and lines, and using two-dimensional viewpoints. They argue that such conventions

> work to imbue visualizations with the quality of objectivity (which brings together other qualities such as transparency, scientific-ness and facticity). This produces the impression that visualizations are showing the facts, telling it like it is, offering windows onto data. It is not visualization designers who are creating this sense of objectivity, we propose, but rather the conventions on which they necessarily draw in producing visualizations.
>
> (p. 716)

(p. 511) These are necessary corollary concerns to raise as digital data are becoming ever more embedded in social methods.

Data sources. Digital media and technologies provide for a range of data types—from social interactions, buying preferences, cultural consumption through geographic location data and more. How we both understand and use this variety of data types to undertake research and to understand our digital society is a key focus for this domain. As noted earlier, digital data sources are not free of bias, may be skewed to certain aspects of social behavior, and need to be understood in their context. One of the most obvious current sources of digital data are social networking sites. boyd and Ellison (2007) examine key characteristics of social network sites, while exploring their history and how academia had been studying them up to that time. They defined social network sites as

> Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system.
>
> (p. 211)

Of course, in the time since then, social networking sites have moved beyond the web to mobile and smart devices, making them even more embedded in everyday life. boyd and Ellison note how it is the social basis of the networked interaction that is key—even if these social interactions have a transaction-like format. They note the same issues as all social research: that understanding of the context and the social structures and groups within (or that form through) the use of social networking are key.

One way to address such issues is to include communities in the collection and analysis of data. For example, Elwood (2006a) combines participatory research with the use of GIS data (sometimes termed as public participation GIS), in part through everyday practices of knowledge production. The availability of large data sets with GIS data embedded (e.g., from mobile devices) has expanded the range of potential analyses. As Elwood notes, such work is not straightforward. Drawing on participatory practices involves exclusion and inclusion and also contradictory and ambiguous priorities and strategies for social and spatial change. Elwood states:

> Interventions in the participatory processes in which GIS is used have included strategies for incorporating local spatial knowledge in these processes. Such adaptations include collaborative mapping exercises, community review and critique of spatial data developed for a GIS, collective field work to gather data for a project, or community conflict mediation through a GIS application.
>
> (p. 199)

Elwood also reiterates a version of the points made by Kennedy earlier—that representations of digital data, in this case GIS data, are not neutral. They involve a range of (p. 512) selection and presentational choices that link the final representations to the contexts of their production:

> Representations of research results reveal similar ambiguities, with some representational forms proving to be accessible and useful for some audiences and situations but not for others. Using GIS in ways that expand the forms of spatial knowledge that can be included may have the unintended consequence of limiting the capacity of some participants to use GIS or gain access to maps and data produced.
>
> (p. 206)

But digital data also change how we "do" research; creating new opportunities and making new forms of analysis possible. But we have to take into account the points made earlier that data from digital systems may foreground certain behaviors (e.g., transactions) and that we need to draw on other sources for a full picture. For example, Crampton et al. (2013) provide an outline of the way big data affects the practice of critical human geography, showing how these are socially produced spaces that combine virtual and material spaces. The authors propose five extensions to mapping geofenced data in what they call "beyond the geotag": going beyond (1) social media visualizations which include geographic coordinates; (2) spatialities of the "here and now" and accounting for relations as they evolve over time; (3) the proximate, meaning including more dimensions such as social network analysis; (4) the human towards data that is produced by bots; and (5) the geoweb, meaning to include different types of sources such as governmental data sources. As they note of digitally generated data,

> … while it is often high in quantity, it is not necessarily equally high in quality. Naturally, big data will often yield insights in and of itself, but we argue that by leveraging the available user-generated data … with other data sets, and by marrying and tracing interactions between user-generated data and events outside the users' knowledge or control, that an additional richness is provided to an analysis otherwise impossible by limiting oneself to single data source.
>
> (p. 137)

Ethics and impact. The final points made previously in regard to "not always benign ends" highlight the need to address the ethics of data derived from digital systems. Ethics issues have been raised across all the domains, especially in regard to the use of data. It seems fitting here to unpack these and indicate some prevalent concerns. We would argue that there are four main areas of ethical concern for digital research and especially in regard to data and representations. The first is *digital inequalities*—sometimes referred to as digital divides, digital exclusion, ICT divides or information divides among other terms. There are deep ethical concerns about the impacts of lack of digital access, skills and knowledge can have on citizens. These are not just concerns about the economics of digital exclusion—be that the costs of access or the work and employment consequences of limited digital skills. Rather, they talk to the consequences for citizens in all the domains addressed in this book of not having, having limited, or having differentiated, access to digital technologies (see, for example, chapters 5, 15, and 19). As Mordini et al. (2009) note,

(p. 513)

> The digital divide cannot be characterised solely as a consequence of socio-economic variables nor can it be conceptualised solely in terms of socio-economic priorities. Social dynamics, personal motivations and cultural elements are as important as economic factors. Digital inclusion, in practice, implies changes affecting all these threads of the social fabric and promises benefits to society including economic development, health care improvements and enhanced levels of social inclusion.
>
> (p. 207)

Much research and policy has been undertaken to understand digital inequalities, but these are not always framed in terms of ethics.

First, we would argue that these are fundamentally ethical issues, following Mordini et al.:

> We need a flexible and dynamic ethics of digitalisation which takes into account not only the need to protect individuals from unlawful intrusions, but also the enabling side of privacy and data protection, i.e., enabling individuals, with different capabilities, to forge relationships, to stay authentically active in society, to express and share their views.
>
> (p. 218)

Second, we would argue that *ethics may have taken a back seat to both technical and business opportunity* as digital technologies have been developed and deployed. These concerns have been addressed in a variety of publications in our data. For example Wright (2011) proposes a framework for ethical impact assessment that can be applied to various information technology applications such as policy, service, projects, or programs. The four principles that the ethical framework outlines are autonomy (which includes lib-

erty and agency), dignity, informed consent (freely given and informed), and safety. Other issues to take into account are social solidarity, inclusion and exclusion, accessibility, discrimination and social sorting, value sensitive design, sustainability, equality and fairness, and transparency. Some of the tools to investigate whether an application is ethical are through consultations and surveys, expert workshops, a checklist of questions, an ethical matrix, consensus conferences, and a citizens' panel. The paper argues that:

> … ethical impact assessment is needed of new and emerging technologies because technologies are not neutral, nor value free. Technologies, how they are configured and used, reflect the interests and values of their developers and owner … [and that] ethical impact assessment is also needed because ethical considerations are often context-dependent.
>
> (p. 223)

Third, there are many and complex issues around the *use of digital data*. This has recently been framed in terms of the uses of "big data" but debates are pertinent to many forms of data collected via digital media and technologies. As Crawford et al. (2014) note, critical takes on "big data" cover politics, ethics, and epistemology. These are issues of power and control over creation and use of big data, social values around its use, and the ethics of what it represents. Akin to points discussed earlier by Ruppert et al. and by Kennedy et al., they argue that

(p. 514)

> It is big data's opacity to outsiders and subsequent claims to veracity through volume that discursively neutralizes the tendency to make errors, fail to account for certain people and communities, or discriminate.

Fourth, and by no means last, there are the standard *ethical concerns of conducting research*. The accessibility, often in public contexts, of digital data may give rise to an assumption that it is simply available for research use. In fact, like all research, the analysis of data from digital systems requires thorough ethical review. Nowhere is this clearer than in digital health research. For example Ajunwa et al.'s (2016) article provides an ethical framework for health data collection conducted by corporate wellness programs. This ethical framework focuses on three key areas: (1) informed consent to collect the data, (2) data handling, and (3) employment discrimination concerns. When it comes to consent, employees should be informed of the benefits and disadvantages of joining the health program. They should also be informed about the scientific evidence that backs the program and should know whether the data collected is accurate. When it comes to data handling, it is important to make sure there is transparency about who collects, controls, and owns the data. And lastly, there is a need to make sure wellness programs do not become surveillance programs which exclude people who may cost more money to the company. As they note:

> … an important part of an ethical workplace wellness program is transparency concerning data collection, storage, and also data ownership. Would-be participant employees should be apprised of issues of data management and should also be informed about steps taken to safeguard the data.
>
> (Ajunwa et al., 2016, p. 478)

Data representation and other domains. There is not space here to address how data and representations are key to both the research questions and the methods for all the domains discussed in this book. While these have implications for all the domains, some domain literature emphasize this issue more than others. There are some social research questions that are about data from or in digital systems. In particular there are questions about what communities, groups, and individuals do with such data. For example, Elwood (2006b) examines the way communities organize urban planning in creative and multifaceted ways (see especially chapters 19 and 22). The work focuses on communities that use digital spatial technologies such as geographic information systems (GIS) to deploy statistical and spatial data analysis as well as mapping to help them plan and monitor neighborhood changes. In particular, Elwood points out that communities produce flexible narratives (neighborhood conditions, needs, goals, activities) for different audiences and agendas, arguing that these communities

> … have devised a more complicated institutional and spatial strategy that allows them to maintain opportunities to insert their spatial knowledge into key decision-making practices, sustain long-term working relationships with other influential agents in urban spatial politics, and enhance their own capacities by drawing on funds, expertise, and advocacy from other actors and institutions.
>
> (p. 324)

(p. 515) This is a key point—data from digital systems can be used by many groups—therefore one of the key social research challenges is that of understanding which and how communities, organizations, groups, and individuals are using such data.

Similarly there are social, political, governance, and research debates about how data are generated, shared, and accessed. For example, McKee (2011) examines three issues that have a huge impact on the future of the World Wide Web and Internet-based communications: net neutrality, corporate data mining, and government surveillance. Net neutrality is about the way content should be delivered equally across networks in terms of their transmission speed and priority. Corporate data mining happens as most online services are provided for free, including software that researchers use such as Google Docs. However, this convenience comes with the cost of this data being captured and recorded and then packaged, repackaged, and transferred (see Rice & Hoffman, 2018 for an analysis of the changing business coverage of attention technologies). McKee concludes with advice on the importance of educating citizens, teachers, researchers, and others about the

changing behavioral patterns around the Internet, especially so as to encourage and promote advocacy for web literacy:

> Even as you read this, data about you is being collected, packaged, shipped and sold all over the world. Data mining for 'interest-based ads' (Google's term) and 'instant personalization' (Facebook's term) is big business, pushing online companies' stock values soaring and challenging the boundaries of what online users will accept.
>
> (p. 280)

We note that revelations and concerns about these companies' use of such data can also cause their stock values to drop.

This therefore has implications for how to think about educating citizens—at all levels in the education system—about the types of data collected about us, its uses, and the consequences of it being shared:

> As we integrate in ever more complex ways Web technologies in our classes, as we develop digitally-focused writing programs, writing majors, and graduate degrees, we can aim to build in—as workshops, as activities or units of some courses, as a course unto itself—explicit discussion of policies that shape and will shape the Internet now and in the future.
>
> (McKee, 2011, p. 287)

There are also deeper implications about how we do social research. In one of the project workshops a question was raised about how research funding, design, and ethical assessment could keep pace with the need to undertake research "on the fly" or "in real time." As Ruppert et al. (2013) pointed out earlier, data from digital systems can be continuous—often reflecting potentially much more rapid social processes. This creates the possibility of not only undertaking research in real time but the need to understand these faster-paced social phenomena. As an example, Elmer (2013) examines vertical tickers on leading social media, focusing on the Canadian Broadcasting corporation, to (p. 516) show how political parties intervene in real time on Twitter during political debates. Elmer suggests that Internet studies must engage with "live-research" in order to understand Internet politics and dynamics:

> Real-time or 'live' research is a bit of a misnomer in that it requires the pre-setting of a research agenda, a method of data collection, and, in this instance at least, a heavy reliance upon other forms of near real-time comparative data (e.g., the CBC's debate transcripts). Live research should therefore be viewed and understood as an effort at developing methods of collecting and analyzing data flows on platforms that hyper-accentuate the present, rather than simply enacting research and analysis in real time.
>
> (p. 27)

Elmore concludes that

> Live research, as such, serves not only to question and understand the interface time of social media practices and platforms, but also challenges the time-compressed and space-delimited sphere of academic scholarship.
>
> (p. 28)

Theory, Method, and Approach

This analysis builds on Borah (2017). Most of the analyzed papers (70%) were inductive, either describing findings or building theory (Table 18.5). The papers were predominantly focused on reviews of prior work and secondary data (overall 70%) with only 29% undertaking primary data work (Table 18.6). Overall the literature is therefore far more reflective and involving commentary on the issues than that in the other six domains. The main disciplines from which theory was used or for which theory was developed (p. 517) were: Sociology (62.5%), Communications and media (20%), and Psychology (17.5%). Only actual use of theory for the purposes of design or analysis were coded; general reference to prior work and theory were not coded. There was considerable variety in the specific theories applied from these disciplines, though there was no substantive clear preference. The main specific theories were from sociology (62.5%; sociomateriality, structuration, and critical theory), and communications and media (20%; with uses and gratifications, 55% as the main one).

In this domain, the majority of studies (53%) did not involve research methods, with about a quarter applying non-discourse qualitative analysis (26%) (see Table 18.7). Where primary research was undertaken, the main research methods were surveys (14%), interviews (14 percent), literature reviews (14 percent) and experiments (12 percent). The plurality of the empirical work focused on case studies (40%) with a limited number of general population studies (Table 18.8), reflecting the review and commentary nature of the materials. Less than 2% of studies overtly stated that they were using a “big data” approach.

Table 18.5 Epistemological Approach

	Percent
Deductive (testing of existing theory)	29.6
Inductive (conclusions driven by data)	70.4

Table 18.6 Empirical Approach	
	Percent
Discursive/descriptive (no new data or theory)	37.2
Primary empirical (data collected and analyzed)	27.4
Secondary empirical (analysis of existing data)	16.8
Theoretical (synthesis of current or prior work)	18.6

Table 18.7 Analytic Approach	
	Percent
Discourse (textual-linguistic-discourse)	2.1
Not applicable	53.1
Qualitative (textual-non-discourse)	26.0
Statistical (numerical)	18.8

Table 18.8 Study Population	
Population	**Percent**
Case study(ies)	40.4
General population	22.8
Specific group	36.8

This was the most distinct data set with limited empirical studies across the domains. At the same time the topics and issues raised were far more clearly “born digital” in that they focused on what the consultation workshop termed the “datafication” of people and society. As already noted, some of these questions are not new, having been asked of the impacts of ICT at home and work for much of the last 30 years. Yet, the intensity of the issues and the breadth and depth of the role of digital technologies adds considerable weight to making such questions mainstream in social research topics, theories, methods, and approaches.

This was the only area where an overt discussion of the “social construction” of digital technologies, data, and algorithms clearly surfaced. The team saw this as a (p. 518) foundational question for all the domains as it cuts to the heart of questions of technological determinism that shadow research on society and technology. It was felt that such issues should underpin any research within the other six domains. This domain also clearly had the closest connection to debates on the uses and impacts of the digital tools in research —though it presented very few studies actually using these! We would argue that a key element of future research deploying digital tools should be robust reflection on their efficacy, and also clear documentation of the practical steps required for their use.

Delphi Review

Here, the results of the Delphi process for the Data and Representation domain cover: suggested scoping or research questions, key topics to address within these questions, and key challenges to researching these questions.

Future Research and Scoping Questions

The Delphi review identified a set of scoping questions for the domain, which were coded into the seven categories detailed in Table 18.9 (citizen and community use of data; citizen interaction with data and algorithms; data literacy; methods; power and accountability for data and algorithms; social construction of data and algorithms; and social implications of data and automation). Their ranked importance from the confirmatory survey is given in Table 18.10, with social implications ranked highest and power and accountability ranked second highest. These two lists closely match.

Table 18.9 Delphi Review Scoping Questions

Question category	**Example questions**
Citizen and community use of data	Alternative: How do groups across society relate to, trust, and experience datasets, algorithms, and data analysis that impact directly and indirectly upon key features of contemporary life? How are citizens informed of the immediate and potential later uses of data that they provide in and of their uses of both commercial and public digital services?
Citizen interaction with data and algorithms	What moments of intervention within digital life are programmed and expected? What range of motion is possible? Sub-question: to what extent is trust a feature of our relationships to data and algorithms? How do people feel (affectively) about algorithms and Big Data?
Data literacy	What capacities of thought are necessary to recognize forms of algorithmic governance in everyday life? How do we live with the algorithms and data analysis used to shape key features of our lives; how do we determine and ensure their trustworthiness? How do we enhance data literacy to improve our collective abilities to interrogate, assess, understand, and communicate about the algorithms and data analysis increasingly shaping key features of our lives? To what extent do we understand the algorithms and data that shape our lives?
Methods	Moreover, which approaches should be developed or adopted for the study algorithmic culture?

Power and accountability for data and algorithms	How do we increase the accountability, transparency, and oversight of the algorithms and data analysis that influence key features of our lives? Based on Tony Benn's five questions on power: What power do specific datasets and algorithms have over the lives of citizens in contemporary life? Where does that power originate from? In whose interests is it exercised? How is it held to account? And how can it be avoided or removed?
Social construction of data and algorithms	Who are the organizations and groups that create socially consequential algorithms? How do socially consequential algorithms (e.g., for social media news feeds and consumer recommendations) reflect the social backgrounds of their creators? How do representations and discourses produce consent or dissent about algorithms and Big Data?
Social implications of data and automation	What are the possibilities that you see for identifying the social, economic, and political costs, as well as the benefits to be derived from expanded use of algorithms, artificial intelligence, and data analysis more generally? What kind of research needs to be done to understand the scope and impact of algorithms? What are the effects of algorithms and data analysis? How do we live with the algorithms and data that now shape key features of our lives? How do we materialize data? What do you see as the most promising paths toward the assessment, evaluation, and minimization of the mal-distributed harms associated with expanded use of algorithms and massive data analysis? How do we make sense of these materializations and incorporate them into our everyday lives? How to describe and analyze the consequences of datafication as well as algorithmization?

	Relative to other determinants of social position, such as wealth, education, culture, etc., what influence do specific algorithms and data analysis carried out by governments and private firms have on individual and collective social welfare? What prior forms of techno-social relations created foundational experiences for the speedy pervasiveness of digital life? How to account for the drive towards further quantification and metrification of everyday life?

Table 18.10 Delphi Review Scoping Questions Ranked by Importance

Question category	**Percent**
Social implications of data and automation	24.4
Power and accountability for data and algorithms	22.2
Citizen interaction with data and algorithms	15.6
Data literacy	15.6
Citizen and community use of data	11.1
Social construction of data and algorithms	11.1

Specific scoping questions identified in the Delphi review were coded into nine categories (see Table 18.11), with social impacts ranked highest, but closely followed by privacy and surveillance, citizens/everyday life, and open data/algorithm transparency/accountability: The ranked importance of these from the confirmatory survey are presented in Table 18.12, showing that social implications; privacy and surveillance; citizens/everyday life experiences and uses of data; and understanding open data/algorithm transparency/and accountability were rated by over half of the participants as “very important.” As with the scoping questions, those topics that were most commonly cited in the Delphi workshop were generally also those deemed most important in the confirmatory survey.

Table 18.11 Key Topics Ranked by Percent of Delphi Survey Responses

Topic	Percent
Social impacts	20
Privacy and surveillance	18
Citizens/everyday life	16
Open data/algorithm transparency/accountability	16
Exclusion/inclusion/divides	12
Data visualization/social construction	6
Methods	6
Digital identity	4
Economics	4

Table 18.12 Key Topics Ranked by Importance from Delphi Survey

Topic	Very important	Important	Neutral	Unimportant	Very unimportant
Social impacts of data	86.7%	13.3%	0.0%	0.0%	0.0%
Privacy and surveillance	60.0	33.3	6.7	0.0	0.0
Citizens/Everyday life experiences and uses of data	53.3	33.3	13.3	0.0	0.0
Understanding Open data/Algorithm transparency Accountability	53.3	33.3	13.3	0.0	0.0
Data exclusion/inclusion/divides	40.0	53.3	6.7	0.0	0.0
Digital identity and data	40.0	33.3	20.0	6.7	0.0

Data visualization/Representation/Social construction of data	40.0	13.3	46.7	0.0	0.0
Research methods	26.7	33.3	33.3	6.7	0.0
Economic impacts	20.0	66.7	0.0	13.3	0.0

Research Challenges

The consultation workshop was in broad agreement with the preceding scoping questions as research questions, but argued for a “data”-focused approach with five alternate ways of viewing the questions and topics, presented in Table 18.13.

Table 18.13 Data-focused Topics and Challenges

Topic	Challenge
Datafication	Ownership, exploitation, rights, boundaries, new sources How is data being stored and by whom? Data bias: inequity and stereotypes in the data? Archiving: tools, algorithms and processes
Data literacies	Making data and processes visible Domain and general literacy People who do not want to/cannot be “datafied”
Privacy, security, and trust	Needs to know more about the difference between personal and machine data Access and permissions Citizen choice in data creation and use Unintended consequences
The future?	Need to think beyond the current data environment
Data interpretation	Beyond data to meaning AI and IoT and how they use data Algorithms and meaning Data semantic gap Accountability, social values, and transparency

Table 18.14 Challenges Ranked by Percent of Cases

Challenge	Percent
Methods	57.9
Analytics and measurement	7.9
Combining old and new social research methods	7.9
Concepts	15.8
Social measures	5.3
Understanding and developing new research methods	21.1
Social theory and social questions	7.9
Access to data	5.3
Data literacy	5.3
Education	5.3
Ethics	7.9
Inequality/exclusion/inclusion/divides	5.3
Interdisciplinarity	5.3

Table 18.15 Challenges Ranked by Importance from Delphi Survey

Challenge	Very important	Important	Neutral	Unimportant	Very unimportant
Ethics	66.7%	26.7%	6.7%	0.0%	0.0%
Data inequality/exclusion/inclusion/divides	53.3	40.0	6.7	0.0	0.0
Interdisciplinary working (Computing and social science)	53.3	26.7	13.3	6.7	0.0
Methods—Combining old and new social research methods	46.7	26.7	20.0	6.7	0.0
Social theory and social questions	40.0	53.3	6.7	0.0	0.0
Methods—Concepts	40.0	33.3	26.7	0.0	0.0

Higher education and training	40.0	20.0	40.0	0.0	0.0
Access to data	20.0	60.0	20.0	0.0	0.0
Methods—Analytics and measurement	20.0	53.3	26.7	0.0	0.0
Methods—Social measures	20.0	53.3	20.0	6.7	0.0
Data literacy	20.0	46.7	33.3	0.0	0.0

(p. 519) (p. 520) (p. 521) The Delphi panel identified eight categories of challenges in undertaking research in this domain: methods; social theory and social questions; access to data; data literacy; education, ethics; inequality/exclusion/inclusion/divides; and interdisciplinarity (see Table 18.14). Over half of the cases involved methods issues, so this category has been further divided into analytics and measurement; combining old and new social research methods; concepts; social measures; and understanding and developing new research methods. Over half of the participants ranked the three challenges of ethics; data inequality/exclusion/inclusion/divides; and interdisciplinary working as "very important" (Table 18.15). Although the ethics and inequality challenges rankings do not match with their percentages in Table 18.14, these are, nonetheless, key cross-cutting issues. The challenges identified point towards specific concerns in working across the social (p. 522) sciences, information studies, and computer science disciplines, as the tools and methods being used often originate in computer science and information studies, but must be integrated with or translated into social science. This was the only area where there was explicit comment on the need to provide higher education support to develop and train both students and researchers in new methods and deeper data literacy.

(p. 523) To conclude, this domain clearly separated out a set of social science research questions and areas, with topics that mixed both research and methods issues. Challenges were predominantly around methods.

Conclusion

Contemporary research in the Data and Representation domain studied here appears to have focused on: data methods (science and methods, big data, and Google), data sources (social media and mobile), areas of focus (global and urban culture, consumer services, health, law and hate speech, gender, Twitter and politics, governance, and cybercrime), and other topics (ethics and impact). These areas closely match the areas identified by the Delphi process. These include social research questions (citizen and community use of data, citizen interaction with data and algorithms, data literacy, power and accountability for data and algorithms, social construction of data and algorithms, and social implications of data and automation). As well, they involve social research topics and challenges (social impacts of data, privacy and surveillance, citizens/everyday life experiences and uses of data, understanding open data/algorithm transparency/accountability, data exclusion/inclusion/divides, digital identity and data, data visualization/representation/social construction of data, and economic impacts). And they also include methods challenges (interdisciplinarity, analytics and measurement, combining old and new social research methods, concepts, social measures, understanding and developing new research methods).

(p. 524) Missing from this domain are substantive empirical studies of either the research questions, or of the implementation of digital methods. We would argue that this domain therefore needs to develop a set of robust case studies addressing the key research questions identified by the Delphi process.

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Notes:

([1.]) As part of the review, The Digital Humanities Institute at the University of Sheffield applied concept modelling techniques to a curated corpus of 1,900 journal articles from the period 1968 to 2017. Concept modelling is a computational linguistic process that involves identifying the emergence of concepts, or key ideas, via lexical relationships. For the purposes of the review, lexical relationships were limited to high-frequency co-occurrences of terms as pairs and trios. The process is entirely data driven and resulted in 2 million rows of data. The website https://www.dhi.ac.uk/waysofbeingdigital/ provides access to the top 50 most frequently occurring pairs and trios through a series of data visualizations. Click on *View Data Visualisations* at the top. Then check/submit which of the seven ESRC domains you are interested in (including all). Then choose the visualization. These show configurations across selected time frames. Choose bubble chart, tree map, zoomable pack layout, or network diagram, by individual subject or by all seven subjects combined, by document or concept frequency. You can similarly search the analyzed documents (all, by subject, author, concept, concept trio, and year) by clicking on *Browse Articles* at the top. Also, see https://waysofbeingdigital.com/literature-analysis-interactive-results/ for interactive visualizations with mouse-overs of the main clusters of concepts within each Domain, and the relative frequency of concepts associated with each cluster.

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Simeon J. Yates (PhD, Open University UK, 1993) is Professor of Digital Culture and Associate Pro-Vice-Chancellor Research Environment and Postgraduate Research at University of Liverpool. His research on the social, political, and cultural impacts of digital media includes a long-standing focus on digital media and interpersonal interaction. More recently, he has worked on projects that address issues of digital inclusion and exclusion. He was seconded to the UK Government's Department of Digital, Culture, Media, and Sport (DCMS) in 2017 to act as research lead for the Digital Culture team. He remains the joint-chair of the DCMS Research Working Group on Digital Skills and Inclusion. His prior work covered topics such as the use of digital technologies in the workplace, digital media use during crises, and ICT use by the security services. The majority of his research has been funded by the Economic and Social Research Council (ESRC), the Arts and Humanities Research Council (AHRC), EU, and industry. Simeon's work has often been interdisciplinary and has predominantly involved creative and digital industry partners. He led on a major Engineering and Physical Sciences Research Council (EPSRC) funded interdisciplinary program (Engineering for Life) while at Sheffield Hallam. Simeon has been researching the impacts of the internet and digital media on language and culture since 1990. His PhD thesis (1993) is a large-scale linguistic comparison of speech, writing, and online interaction. Subsequent published work has covered analyses of gender differences in computer-mediated communication (CMC), gender and computer gaming, email and letter writing, and science in the mass media. Simeon has written text books on social research methods—in particular, linguistic and discourse analytic methods. https://www.liverpool.ac.uk/communication-and-media/staff/simeon-yates/

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