ETHICAL IMPLICATIONS OF BIG DATA ANALYTICS

Conference Paper · June 2016

CITATIONS
20

READS
32,589

4 authors, including:

Ida Asadi Someh
The University of Queensland
28 PUBLICATIONS **777** CITATIONS
SEE PROFILE

Christoph Breidbach
The University of Queensland
52 PUBLICATIONS **2,473** CITATIONS
SEE PROFILE

Michael Davern
University of Melbourne
53 PUBLICATIONS **1,673** CITATIONS
SEE PROFILE

ETHICAL IMPLICATIONS OF BIG DATA ANALYTICS

Research in Progress

Asadi Someh, Ida, University of Melbourne, Victoria, AU, iasadi@unimelb.edu.au
Breidbach, Christoph F., University of Melbourne, Victoria, AU, cbreidbach@unimelb.edu.au
Davern, Michael, University of Melbourne, Victoria, AU, m.davern@unimelb.edu.au
Shanks, Graeme, University of Melbourne, Victoria, AU, gshanks@unimelb.edu.au

Abstract

This study aims to identify, define, and prioritize ethical concerns related to big data analytics as they pertain to individuals, organizations and society. Big data analytics is a fast evolving phenomenon with poorly understood consequences. Identifying and exploring its ethical implications is therefore important for both users of big data, and for those who are the target of its use. Our research design is based on a Delphi study of academic and practitioner experts who illuminate the ethical concerns associated with big data analytics. Our emerging empirical insights thereby provide both, an important theoretical contribution to the information systems literature, as well as informing managerial and policy guidelines for implementing, and ethically benefiting from, big data analytics.

Keywords: Big data, Analytics, Ethics

1 Introduction

Big data analytics translates 'big' data, the result of our new ability to collect, store, and process increasingly large and complex data sets from a variety of sources, into competitive advantage (LaValle and Lesser 2013). Big data analytics can generate new insights about the world we live in. Potentially positive consequences associated with big data analytics range from service innovations, higher product margins, new business models (Mayer-Schönberger and Cukier 2013) to improved healthcare (Murdoch and Detsky 2013). Today, organizations can enhance customer experience by offering them innovative and personalized products and services, and governments and law enforcers can protect citizens from criminals (Chen et al. 2012; Breidbach and Maglio 2015). However, the use of big data is increasingly challenged. Misuse of personal information, breeching privacy, profiling of individuals and discrimination are some examples (Clarke 2016; Markus and Topi 2015; Markus 2015; Martin 2015; Newell and Marabelli 2015; Richards and King 2014; Wigan and Clarke 2013; Zuboff 2015). Consequently, big data analytics can have unintended, and potentially negative consequences at the individual, organizational, and societal level (Clarke 2016; Markus 2015; Wigan and Clarke 2013; Zuboff 2015). Examples for the unethical use of big data analytics and the resulting reputational and economic effects include the public's reaction to Target's alleged prediction of a teenager's pregnancy (Duhig 2012), and the US Federal Trade Commission investigation of the US$1billion merger between DoubleClick and Abacus, which was feared to provide new abilities to track customer behaviour (Deighton 2001).

Despite the apparent challenges associated with big data analytics, there is no widespread agreement about what constitutes ethical versus unethical use of big data. Our present study seeks to address this gap in the literature. We build on earlier definitions of business ethics as the 'moral rules, codes, or principles which provide guidelines for right and truthful behaviour in specific situations' (Lewis 1985, p. 382), and ask:

What are the key ethical concerns related to the use of big data analytics for individuals, organizations, and society?

We view big data analytics as a social process where different stakeholders interact to create, use and govern analytical processes driven by big data. We argue that when viewed from individual, organizational and societal perspectives, this social process of big data analytics is not ethically neutral. We employ a Delphi study of a diverse range of experts to provide rich insight on the ethical issues of big data analytics from these three perspectives. Through the Delphi approach, we intend to develop consensus views of what constitutes ethical versus unethical use of big data, to inform regulators, managerial practices, and those affected by big data analytics. By exploring the ethical implications of big data analytics from multiple perspectives, we seek to aid all stakeholders in balancing the potential ethical risks against the economics and social returns.

The paper is organized as follows. First, we review the recent literature on big data analytics and conceptualize it as a social process involving individuals, organizations and society. We then examine the existing, largely non-empirical, research on ethics and big data analytics as foundation for our empirical Delphi study. Next, we discuss how a Delphi study can illuminate the ethical issues of big data analytics as a social process involving individuals, organisations and society. Following that, we provide our initial findings. Finally, we conclude the paper and suggest future research directions.

2 Background

2.1 Big Data Analytics

Big data analytics represents the next logical step in the evolution of business intelligence and analytics systems (Chen et al. 2012), and is commonly defined using the three characteristics of volume, ve-

locity and variety. Volume refers to the increasing amounts of data that are captured (Russom 2011), variety implies that data is captured and combined from multiple sources (Russom 2011), while velocity implies data is generated with increasing speed (Russom 2011). However, attempting to understand big data analytics by focusing on descriptive attributes of the data like volume, velocity or variety limits our understanding of the nature of big data analytics as a social process. We posit that such a descriptive lens is neutral at best, and does not provide much-needed new insights into the emergent processes and outcomes that are driven and enabled by the interactions between stakeholders in big data analytics (Richards and King 2014). We therefore aim to extend the current discourse by focusing on big data analytics as a social process involving individuals, organisations and society.

Drawing on Zuboff (2015), we define big data analytics as interactions among stakeholders (individuals, organisations and society) in which stakeholder data is contributed, collected, extracted, exchanged, sold, shared, and processed for the purpose of predicting and modifying human behaviour in the production of economic or social value. The exchange of data is characterised by its volume, velocity, variety, and uncertain source or veracity. The exchange transactions, however, are characterised as not generally reciprocal between stakeholders. This raises the questions as to whether or not the interactions and equity in the distribution of the costs and benefits of big data analytics is ethical for different stakeholders.

Our stakeholder perspective helps us to understand and explain the ethical challenges of using big data analytics. First, big data originates from individuals who use social media services such as Google, Facebook or Twitter, as well as digital devices that have built-in sensors such as location sensors in smart phones and speed sensors in cars (Derikx et al. 2015). These sensors generate huge amounts of data about an individual's behaviours and sends it to organizations that are interested in identifying patterns and relationship for the purpose of monetization (Newell and Marabelli 2015). Second, organizations source, manage, analyse and share big data for monetary reasons (Martin 2015). Organizations exploit individuals for data by providing them with a variety of big data applications (Zuboff 2015). The data extracted from individuals is then shared with data brokers and aggregators or sold until there is no value left for exploitation (Martin 2015). Third, from a societal level perspective, big data analytics has given rise to new markets, in which exchange transactions are often not reciprocal and ability of individuals in the society to exercise freedom of choice when buying products and service is quite different. This new market operates based on the monitoring and surveillance of individuals and groups and manipulating their behaviour for the economic gain of those in control of the data (Zuboff 2015). Societal actors such as government authorities and industry associations are responsible for regulating and shaping this new market. In short, viewing Big Data as a social process highlights the differences in roles and perspective of individuals, organizations and society stakeholders in creating, managing and governing the overall process of big data analytics. We therefore identify ethical factors in relation to these three important stakeholders.

2.2 Ethical Implications of Big Data

The definition of ethics as moral guidance for behaviour and principles of truth (Lewis 1985) reflects the Kantian and utilitarian viewpoints as theoretically underpinning the ethical behaviour of human economic actors (Mingers and Walsham 2010; Newell and Marabelli 2015). Kantian ethics argues that ethical action is based on moral values and principles, including honesty and responsibility. The Kantian perspective is therefore not concerned about the consequences of those the actions of individual actors. Conversely, the utilitarian theory focuses on consequences or outcomes. Specifically, an action is considered ethical if it is intended to maximize positive outcomes for the majority of actors (e.g. citizens in a country). Both viewpoints offer benefits and limitations. For example, the utilitarian theory creates injustice for minority groups, since the greater good of a majority is central to the discourse. However, one might argue that identifying the overall good in our modern and competitive world is

not straightforward (Mingers and Walsham 2010). On the other hand, subjectivism is the main disadvantage of the Kantian approach (Mingers and Walsham 2010).

While ethical concerns are not new to the IS literature (see e.g. Davison 2000; Einings and Lee 1997; Mason 1986; Oz 1992; Smith and Hasnas 1999) the topic has been largely underrepresented in the field. Furthermore, the capabilities of big data analytics brings to the fore a larger array of ethical concerns with potentially more wide-reaching implications for individuals, organizations and society. Some ethical issues, such as privacy have been explored already (e.g. Lyon 2014), but other, potentially greater concerns are not well understood. For example, algorithmic decision-making, profiling of individuals and discrimination, control and surveillance of individuals and lack of transparency in the big data value chain, all raise concerns regarding the ethical use of big data analytics, and the social consequences, of big data analytics (Martin 2015; Newell and Marabelli 2015; Wigan and Clarke 2013; Zuboff 2015).

Our analysis of the existing literature highlights several potential ethical implications associated with big data analytics. For one, big data analytics relies on algorithms to support human decisions (Newell and Marabelli 2015). So called 'algorithmic decision-making' processes data that are captured and combined from different sources and aims to predict individual's taste and behaviour based on their current or past behaviour (Newell and Marabelli 2015). Algorithmic decision-making focuses on identifying the relationships within big data sets and assumes that the identified relationships are meaningful and represent the objective cause and effect in a social phenomenon. One example is to predict the human behaviour based on correlations in a data set, which ignores the human design and inherent error and biases in data, measures and analysis (Clarke 2016; Zuboff 2015).

Second, profiling of individuals could result in discrimination as a type of unethical social impact (Zuboff 2015). Profiling could occur by classifying individuals into groups, intentionally or unintentionally, based on race, ethnic group, and gender, social and economic status, while offering or restricting special treatments or services to individuals or groups (Martin 2014; Newell and Marabelli 2015). The algorithms that enable such actions not only ignore outliers (for example by reverting to mean), but also provide the basis for discrimination among individuals or groups.

Third, individuals may not be sufficiently aware of what happens to their data after it is collected. The initial data moves through an information value chain, from tracking companies to data aggregators, to retailers. Data aggregators combine the data from multiple sources and create a new picture of individuals based on their data. Ethical issues might arise in each segment of the value chain, with the final owner of the data using the data for purposes that can be very different from the initial intention. Different segments of the information value chain can be a source of risks and dangers for the initial consumers who created the data at the first place. Recognizing big data not only as a technology, but rather as an industry with several contributing firms such as producers and distributers and customers is therefore important (Martin 2014).

Finally, monitoring and surveillance of individual's behaviour is another phenomenon resulting from the use of big data sets. Organizations then continuously observe and monitor individual's behaviours can offer personalized services and products, which also implies that these individuals are no longer exposed to all options and choices available on a market place. Ultimately, this implies individuals are no longer subject to their basic rights of free choice and behaviour; rather they are under the control and surveillance of algorithms aiming to influence their decisions (Zuboff 2015). This leads to surveillance capitalism with new drivers and forces compared to traditional market-based capitalism (Zuboff 2015). Despite these and other examples about the negative impacts of big data analytics, the consequences for individuals, organizations and society are a poorly understood and under researched topic. A clear understanding of the ethical issues and consequences is required.

While the discourse of the ethical implications associated with big data analytics is just emerging, the existing literature on the topic is primarily discursive, rather than grounded in data collected from an

established research method. Furthermore, it is fragmented, and does not provide the required comprehensive view of the ethics of big data analytics as a social process that can be viewed from multiple stakeholder perspectives (individual, organization, and society). Here, we aim to address these shortcomings.

3 Research Method

The range and complexity of potential ethical issues associated with big data analytics poses substantial challenge for empirical investigation. The breadth of issues, both in terms of ethical concerns and in terms of the technological capabilities that engender them, make both cross-sectional survey studies and intensive case studies problematic. Surveys require measures, and while there are measures for ethical behaviour in general, they are too general for exploring specific ethical issues around specific analytics capabilities. Case studies are challenged by the on-going rapid development in analytical capabilities and the potential for the ethical issues that arise to be too specific to a particular organizational context. We therefore adopt a Delphi study approach to understand the ethical implications of big data analytics. This approach allows us to explore the broad range of ethical issues that arise with a variety of analytics capabilities in multiple contexts and from the perspective of multiple stakeholders. It enables us to identify, define and prioritize the ethical issues in big data analytics.

The Delphi study approach is particularly well suited to exploratory research that focuses on new and emerging issues (Worrell et al. 2013). It involves "systematically soliciting, organizing and structuring judgments and opinions on a particularly complex subject matter from a panel of anonymous experts until a consensus is reached on the topic or until it becomes evident that further convergence is not possible" (Anderson et al. 1994, p478). There are four important characteristics of the Delphi study approach: the use of a purposefully selected panel of experts to provide their opinions; the experts remain anonymous from each other to guard against biases, personal influences and groupthink; communication is used to manage feedback and develop consensus among the expert panel; and multiple rounds of opinion seeking are used to iterate the decision process, allowing participants to reflect on the opinions of other panel members to develop their own opinions (Worrell et al. 2013). The Delphi study approach provides more accurate decisions than other approaches such as focus group and nominal group technique (Worrell et al. 2013).

Our research-in-progress Delphi study involves two panels of big data analytics experts: one panel comprising expert practitioners and the other panel comprising big data analytics academics. The practitioner panel will provide us with a prioritized set of big data analytics issues that are most prominent for practitioners. The academic panel will provide us with a prioritized set of big data analytics issues that are most prominent for big data analytics researchers in general, as opposed to those who focus in particular on ethical issues.

By contrasting our prioritized definitions of ethical issues from expert practitioners and academics with the issues raised in the literature we are able to identify the gaps in both research and practice. Our prioritized definitions also provide the foundation for future research, be it cross-sectional in nature (now that we have established a clearer idea of what to measure) or intensive (now that we have established the issues that generalize across context and analytic capabilities.

Our Delphi study has three consecutive rounds of data collection and concept refinement (following recommendations by Schmidt et al. 2001). The first round identified an initial set of ethical factors related to big data and analytics with respect to the three stakeholder groups in our framework: individuals, organizations, and society. The second round will refine the identified factors and measure participant's satisfaction with the factors and their definitions (Schmiedel et al. 2013). The third round will prioritize the factors. Currently, we have reviewed the relevant literature, proposed an initial framework and completed Round 1 of the Delphi study. The framework will inform the concept refinement process during the Delphi study data collection and analysis. The remaining activities are refining the issues and their definition in the Delphi study process.

3.1 Data Analysis

Our Delphi study received responses from 34 expert participants (17 practitioners and 17 academics) in Round 1. Participating experts come from a broad range of Western economies. Each member of the research team individually identified and coded at least one half of the data to develop a tentative list of issues for each of our stakeholder groups. We then shared our lists, refined them, and revalidated them back to the underlying data. To guide our analysis, we followed three principles we developed to ensure clarity and consistency. First, we looked at issues from a strict perspective of the relevant stakeholder (individual, organization or society). Second, we sought to develop issues that were conceptually distinct but readily open to be empirically operationalized as measurable constructs in future research (notably some of the issues are conceptualized as formative, some are conceptualized as reflective). Third, we focused on ethical issues that were different in nature, not just magnitude, in big data analytics as compared to traditional data environments.

Table 1 presents the set of issues we have identified in round 1. Each of these issues has an underlying definition as a measurable construct (we do not include the definitions here because of space constraints and because to do so would be premature as at time of writing they are undergoing round 2 review and refinement by our participants). Unsurprisingly, a number of the issues in the literature appear in our analysis but are subsumed by broader or reframed issues when we apply our stakeholder perspectives. For example, the literature was concerned with *discrimination* and indeed we did see concern for discrimination appear in some form or another in all three stakeholder perspectives. However, for individuals it is primarily subsumed by a broader right to self-determination, for organisations it is primarily subsumed in the concerns for the outcome of algorithmic decision-making, and for society it is primarily subsumed in concerns about power imbalances.

4 Initial Findings

We structured our findings in terms of three interrelated key stakeholder groups: individuals, organizations and society. Our initial findings are listed in Table 1 and discussions for different stakeholders follow.

4.1 Individual Issues

Although individuals contribute their data to the big data industry, they do not have ownership rights over their data. Exercising the right of owning one's data means that individuals should be able to benefit from it. Individuals who use digitized services are tracked by providers in return for using their services and lose their privacy. Privacy is the protection of and access to an individual's information (Bélanger and Crossler 2011). This includes freedom from unwanted attention or surveillance. The notion of privacy implies that individuals should have control over their personal data. Yet few people have real control over what is stored about them, whether it is accurate, how it is updated and how it can be deleted (Clarke and Wigan 2013). Large organizations largely retain control of personal data and hence can customize offers and manipulate individuals' behaviour for their own benefit (Zuboff 2015). As a result of this, individuals are not subject to freedom of choice (self-determinism) and can be discriminated against by the algorithms that may profile individuals based on their race, income, gender or social class. Some argue that benefiting from big data analytics comes at a cost, for example by losing privacy and control over data (Newell and Marabelli 2015). There are clear benefits from big data analytics about individuals, including tracking systems for prison populations, the use of sensors to retrieve stolen devices and monitoring of communications related to national security issues.

While individuals need to understand and balance the need for privacy and control over data with the benefits big data analytics can bring (Newell and Marabelli 2015), they are usually not aware of what happens to their data after it is captured. Many big data applications are not transparent, and individuals frequently do not understand what data is stored about them and how it is used. Individuals are generally *unaware* that their data is combined from multiple sources and sold and used as second hand

data by different companies within the big data value chain (Martin 2015). Individuals who are aware of big data analytics processes may find it hard to trust organizations with their personal data. As big data services are becoming ubiquitous in every aspect of individual's lives, individuals become anxious about the misuse of their personal information by big data service providers.

Individual Issues	Data Ownership Data Control Awareness Trust Privacy Self-Determination Fear
Organizational Issues	Competitive Pressure Data Quality Data Sourcing Data Sharing/Disclosure Algorithmic Decision Making Presentation Ethical Capability Ethical Culture Ethical Governance Ethical Performance Reputation
Societal Issues	Power Dependence Social awareness Surveillance Principles and Guidelines Authority Climate

Table1. Initial Issues Identified from Round 1 for Individuals, Organizations and Society

4.2 Organizational Issues

Organizations are pressured to compete on big data analytics. Big data analytics has become a new market for many traditional organizations and a novel business tool for emerging start-ups. Organizations find this new market more lucrative than their primary market and try to exhaust all the value before their competitors do (Martin 2015). However, many organizations struggle to understand, measure, and manage data quality in a big data context. Data quality is an important issue for organizations when managing internal structured data, with ethical as well as economic consequences. It is a much more complex problem with big data that is sourced from multiple data sources in different contexts and includes inferences drawn from unstructured social media data (Clarke 2016; Wigan and Clarke 2013). Further, the data is shared with or sold to other organizations that might also share or sell the data to others and use it for different objectives rather than the initial objective of data collection that the individual consented to.

Big data analytics affects decision-making in several ways. Big data is often obtained through social media data and analysed using statistics that identify the patterns for groups (Wigan and Clarke 2013). These insights might have considerable errors and biases for individuals not conforming to group characteristics. Furthermore when inferences are made about particular individuals, based on data that may be of poor quality, with algorithms that may not be well understood by decision-makers, complex ethical issues result (Wigan and Clarke 2013). This could for example, be problematic if incorrect data or an algorithm led to an unethically discriminatory decision. On the other hand, reducing big data to a limited visual presentation that lacks the information about sources and quality of data can also lead to incorrect unethical decisions (Ekbia et al. 2015). Frequently, when big data informs decision-making, the underlying justifications of the decision cannot be easily understood. Questions related to the responsibility of human decision making arise.

While organizations are investing huge amounts of money and effort on developing their capabilities to source, manage, analyse big data sets, they often do not have a clear understanding of the ethical use of big data analytics. Most organizations do not have ethical data governance practices such as clear standards and procedures for sourcing, analysing and sharing big data, trainings on ethics, ethical leadership and control mechanisms for unethical behaviour. Organizations may push the boundaries in extracting, analysing and sharing data about individuals without considering individual's rights and for the purpose of generating revenue and market share.

4.3 Societal Issues

Societal issues mainly arise because only a few large organizations and countries dominate access to big data. This creates knowledge asymmetries, which could lead to power imbalance and control and surveillance of societies by these entities (Zuboff 2015). While participation in society is becoming more and more dependent on using apps, social networks and sensors, the social evolution and awareness behind big data analytics is very slow. Current principles and guidelines for protecting an individual's privacy rights lag behind technological developments. Similarly, there are no guidelines indicating if, or how, unethical consequences such as discriminations against individuals can be avoided (Clarke and Wigan 2013). This creates an ethical challenge as actors in a society may be able to use big data analytics in ways that are not illegal or even subject to regulation but may be ethically questionable. For example, health population data, matched with genome data, can be used to infer the relationship between gene sequences and disease. Societies need to decide how to balance these benefits with the potential loss of privacy or autonomy (Newell and Marabelli 2015). More broadly, from the societal perspective, there is a concern for the dissemination and enforcement of ethical practices. This can create a climate of anxiety as a whole.

5 Conclusion

In this paper, we conceptualized big data analytics as a social process and identified ethical issues from the perspective of individuals, organizations and society. We use a Delphi study to identify, define, and prioritize ethical issues of big data analytics. Delphi studies are particularly useful because they generate a controlled consensus of expert opinions (Dalkey and Helmer 1963; Worrell et al. 2013) addressing the current lack of comprehensive consensus in the literature as to the nature and importance of the ethical implications of big data analytics. We present the initial finding from Round 1 of the Delphi Study. The final results of the Delphi study will inform all the stakeholders about the ethical factors they need to consider as they engage with and are impacted by big data analytics processes.

6 References

Anderson, J. C., Rungtusanatham, M., and Schroeder, R. G. 1994. "A Theory of Quality Management Underlying the Deming Management Method," *The Academy of Management Review* (19:3), p. 472 (doi: 10.2307/258936).

Bélanger, F., and Crossler, R. E. 2011. "Privacy in the Digital Age: A Review of Information Privacy Research in Information Systems," *MIS Quarterly* (35:4), pp. 1017–1041.

Breidbach, C. F., and Maglio, P. P. 2015. "A Service Science Perspective on the Role of ICT in Service Innovation," *Ecis 2015*, pp. 0–9.

Chen, H., Chiang, R., and Storey, V. 2012. "Business Intelligence and Analytics: From Big Data to Big Impact," *MIS Quarterly* (36:4), pp. 1165–1188.

Clarke, R. 2016. "Big data, big risks," *Information Systems Journal* (26:1), pp. 77–90 (doi: 10.1111/isj.12088).

Dalkey, N., and Helmer, O. 1963. "An Experimental Application of the DELPHI Method to the Use of Experts," *Management Science*, pp. 458–467 (doi: 10.1287/mnsc.9.3.458).

Davison, R. M. 2000. "Professional Ethics in Information Systems," *Communications of the Association for Information Systems* (3), p. Article 8.

Deighton, J. 2001. "DoubleClick Buys Abacus (A)," Harvard Business School Press Case#500091.

Derikx, S., de Reuver, M., and Kroesen, M. 2015. "Can privacy concerns for insurance of connected cars be compensated?," *Electronic Markets*, pp. 1–9 (doi: 10.1007/s12525-015-0211-0).

Duhig, C. 2012. "How Companies Learn Your Secrets?," *New York Times* (available at http://www.nytimes.com/2012/02/19/magazine/shopping-habits.html?_r=0).

Einings, M. M., and Lee, G. M. 1997. "Information ethics: An exploratory study from an international perspective," *Journal of Information Systems* (11:1), pp. 1–17.

Ekbia, H., Mattioli, M., Kouper, I., Arave, G., Ghazinejad, A., Bowman, T., Suri, V. R., Tsou, A., Weingart, S., and Sugimoto, C. R. 2015. "Big data, bigger dilemmas: A critical review," *Journal of the Association for Information Science and Technology* (66:8), pp. 1523–1545 (doi: 10.1002/asi.23294).

LaValle, S., and Lesser, E. 2013. "Big data, analytics and the path from insights to value," *MIT Sloan Management Review*.

Lewis, P. V. 1985. "Defining 'business ethics': Like nailing jello to a wall," *Journal of Business Ethics*, pp. 377–383 (doi: 10.1007/BF02388590).

Lyon, D. 2014. "Surveillance, Snowden, and Big Data: Capacities, consequences, critique," *Big Data & Society* (1:2), pp. 1–13 (doi: 10.1177/2053951714541861).

Markus, M. L. 2015. "New games, new rules, new scoreboards: the potential consequences of big data," *Journal of Information Technology* (30:1), Nature Publishing Group, pp. 58–59 (doi: 10.1057/jit.2014.28).

Markus, M. L., and Topi, H. 2015. "Big Data, Big Decisions for Science , Society, and Business.,"

Martin, K. E. 2015. "Ethical Issues in the Big Data Industry," *MIS Quarterly Executive* (14:2), pp. 67–85 (doi: 1540-1960).

Mason. 1986. "Four Ethical Issues of the Information Age," *MIS Quarterly* (10:1), pp. 46–55 (doi: 10.2307/248873).

Mayer-Schönberger, V., and Cukier, K. 2013. *Big data: A revolution that will transform how we live, work, and think*, Houghton Mifflin Harcourt.

Mingers, J., and Walsham, G. 2010. "Towards ethical information systems: The contribution of discourse ethics," (34:4), pp. 833–854 (doi: Article).

Murdoch, T. B., and Detsky, A. S. 2013. "The inevitable application of big data to health care," *Jama* (309:13), pp. 1351–1352 (doi: 10.1001/jama.2013.393).

Newell, S., and Marabelli, M. 2015. "Strategic opportunities (and challenges) of algorithmic decision-making: A call for action on the long-term societal effects of 'datification,'" *The Journal of Strategic Information Systems*, Elsevier B.V., pp. 1–12 (doi: 10.1016/j.jsis.2015.02.001).

Oz, E. 1992. "Ethical standards for information systems professionals: A case for a unified code," *MIS Quarterly* (December), pp. 423–434 (doi: 10.2307/249729).

Richards, N., and King, J. 2014. "Big Data Ethics," *Social Science Research Network Working Paper Series* (1881:2013) (available at http://ssrn.com/abstract=2384174).

Russom, P. 2011. "Big Data Analytics," *TDWI Best Practices Report* (Fourth Quarter).

Schmidt, R., Lyytinen, K., Keil, M., and Cule, P. 2001. "Identifying software project risks: An international Delphi study," *Journal of Management Information Systems* (17:4), pp. 5–36 (doi: Article).

Schmiedel, T., Brocke, J. Vom, and Recker, J. 2013. "Which cultural values matter to business process management? Results from a global Delphi study," *Business Process Management Journal* (19:2), pp. 292–317 (doi: 10.1108/14637151311308321).

Smith, H. J., and Hasnas, J. 1999. "Ethics and information systems," *MIS Quarterly* (23:1), pp. 109–127 (doi: 10.1145/569905.569908).

Wigan, M. R., and Clarke, R. 2013. "Big data's big unintended consequences," *IEEE Computer* (46:6), pp. 46–53 (doi: 10.1109/MC.2013.195).

Worrell, J. L., Di Gangi, P. M., and Bush, A. a. 2013. "Exploring the use of the Delphi method in accounting information systems research," *International Journal of Accounting Information Systems* (14:3), Elsevier Inc., pp. 193–208 (doi: 10.1016/j.accinf.2012.03.003).

Zuboff, S. 2015. "Big other: surveillance capitalism and the prospects of an information civilization," *Journal of Information Technology* (30:1), Nature Publishing Group, pp. 75–89 (doi: 10.1057/jit.2015.5).