INTRO TO ETHICS – TOPIC 2

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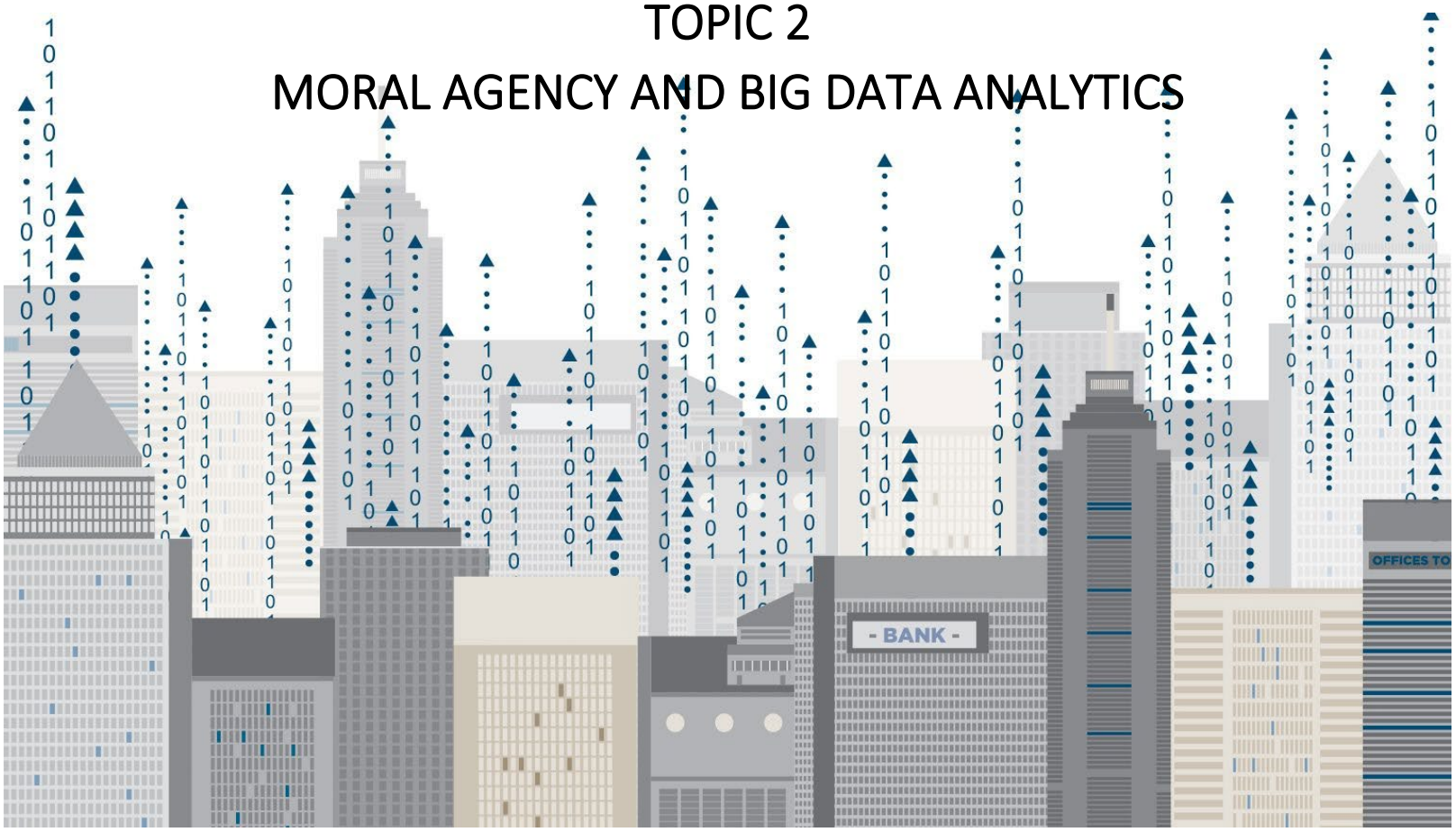
TOPIC 2
MORAL AGENCY AND BIG DATA ANALYTICS

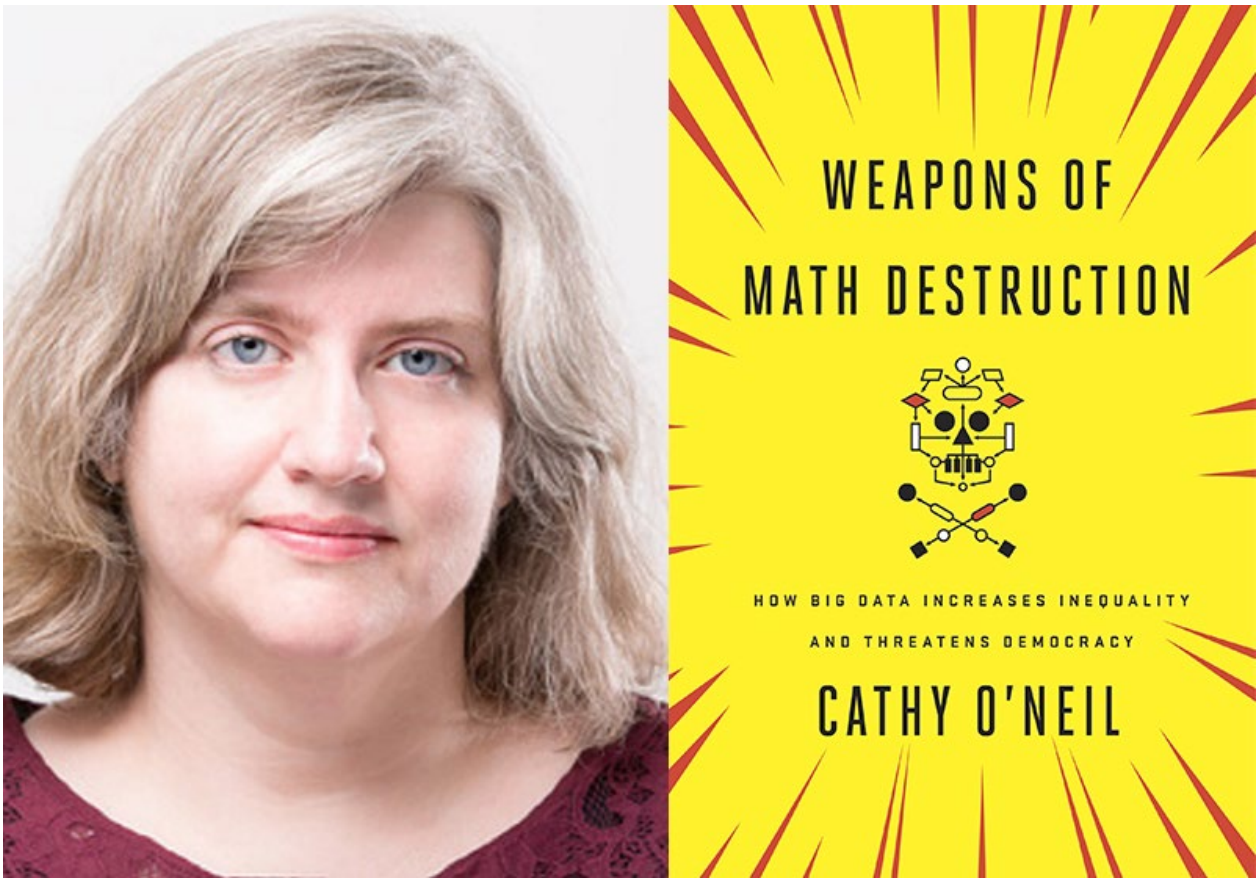


Introduction

This Topic focuses on some of the moral issues associated with the growth of Big Data analytics and its rapidly increasing deployment in numerous human decision-making applications and situations.

We will investigate critical assessments of **Cathy O'Neil**'s text *Weapons of Math Destruction* where she details some of the moral problems associated with algorithmic decision-making. Additionally, we will consider the article "Big Data Ethics" by **Andrej Zwitter** in which he reflects on the impact that the explosion of Big Data analytics is having and is likely to have on personal moral agency – our ability to control the course of our moral life. The final article presented in this section is a **Pew Research report** of a large-scale survey of "technology experts, scholars, corporate tech practitioners, and government leaders" asking them to respond to the following question: **Will the net overall effect of algorithms be positive for individuals and society or negative for individuals and society?** This is a very illuminating survey, especially Theme 3 of the report: *"Humanity and human judgment are lost when data and predictive modeling become paramount."*

What I think that you should take away from this investigation is an increased consciousness of the scope and ubiquity of Big Data analytics and the specific kinds of unique and, in some cases, original moral issues that arise with this nascent and emergent technology. In some ways ethics precedes technology, while in other ways it is always playing catch-up with new technological developments.



One dimension of the moral issues with Big Data arises because Big Data utilizes *proxy measurements* to target or evaluate members of correlative groups. The police analyze zip codes to deploy officers; employers use credit scores to gauge responsibility; payday lenders assess grammar to determine credit worthiness. Zip codes are a stand-in for race; credit scores for wealth; and poor grammar for immigrants. The potential for bias lurks throughout.

Mindless algorithms created by an unknown number of invisible technicians who inevitably and blindly introduce their own prejudices and biases into the algorithms, can result in racism, sexism, ethnic profiling, predatory marketing, prejudicial policies, and other kinds of injustice. This potential for perniciousness is multiplied exponentially by virtue of the sheer scope of Big Data's reach. And the opacity of its insinuation into the most intimate and personal nooks and crannies of our everyday life will most certainly result in transforming our sense of self and our moral value orientation, *without our being aware of it* for the most part, guided by an invisible

human hand targeting the data-driven payload toward decision-making about members of unsuspecting groups. Listen to Cathy O'Neils assessment in the following video.

Cathy O'Neil: The era of faith in Big Data must end (13:19

Here it might be instructive to recall what we learned from the Stanford Prison experiment, Milgram's obedience study, and from Social Psychologists like Sam Sommers, author of *Situations Matter,* discussed earlier, about how background dimensions of situations that we are mostly unaware of can have a big impact on our perception in general, including our self-perception and decision-making. Big Data is the perfect tool for taking advantage of this barely conscious, tacit source of influence. Most folks don't realize it is happening.

The article listed below, "Big Data: Weapons of Math Destruction " by Derek Beres is a review of Cathy O'Neil's book *Weapons of Math Destruction.* Beres's article focuses on the potential for Big Data to cause "dehumanization by numbers" by making decisions that affect people's lives based on algorithms that "create self-perpetuating feedback loops where your phone bill can have more impact on auto insurance than getting hammered and sitting behind the wheel." This occurred in Florida, according to O'Neil, where some residents who had clean driving records were charged more for insurance than others who had DUI's but good credit scores. This unfairness is the result of using abstract and impersonal algorithms that focus on "proxies" (quantifiable data sources) as a way of making decisions in other areas of human interaction. O'Neil details numerous such cases.

For example, in A Math Nerd Wants to Stop the Big Data Monster, Katherine Burton points out that O'Neil "describes companies using ZIP codes as a proxy for creditworthiness, which leads to predatory lending and hiring discrimination." Again, in Math is racist: How data is driving inequality, Aimee Rawlins points out that one of the most compelling sections of O'Neil's book focuses on algorithm-driven recidivist models for the sentencing of criminals:

> *For years, criminal sentencing was inconsistent and biased against minorities. So, some states started using recidivism models to guide sentencing. These take into account things like prior convictions, where you live, drug and alcohol use, previous police encounters, and criminal records of friends and family. These scores are then used to determine sentencing.*
>
> *"This is unjust," O'Neil writes. "Indeed, if a prosecutor attempted to target a defendant by mentioning his brother's criminal record or the high crime rate in his neighborhood, a decent defense attorney would roar, 'Objection, Your Honor!'" But in this case, the person is unlikely to know the mix of factors that influenced his or her sentencing -- and has absolutely no recourse to contest them.*

Big Data and Moral Agency

Once we begin to see the potential for Big Data to impact and influence our lives and our consciousness and to drive social policy, we can begin to understand the kinds of moral concerns that Andrej Zwitter raises in his article Big Data Ethics, about the potential erosion of personal moral responsibility as a result of the nature, growth and impact of Big Data.

According to Zwitter, the invisibility of Big Data's influence is due in part to the speed of Big Data's development, too fast for us to fully comprehend its nature and possible effects; a case of technological development dangerously outpacing moral consciousness development. Part of the reason for this is that the mining and deployment of Big Data is largely invisible and we are all tacitly complicit in its formation. And the Big Data industry is still in its infancy, so things are just getting started. We collect tons more data than we actually put to use due in large part to the development of the internet. Undoubtedly, the amount of interpreted and deployed Big Data will continue to increase as applications multiply.

Here is why Zwitter thinks that Big Data will cause an erosion of individual moral responsibility. He points to the "hyper-connectivity" of current society, witnessed in the explosion of social networking, for example, and driven by Big Data, resulting in the fact that virtually everyone becomes a data collection point that contributes anonymously to some degree to the targeting of *groups* for commercial, policing, evaluative, and other purposes, and which can involve unjust and prejudicial outcomes. For this reason, Zwitter thinks that Big Data will erode individual moral agency and individual moral responsibility.

Let's look at this a little closer. As we learned earlier from Kant, being a moral agent means that you have the capacity to act. Not all bodily movements are "acts," of course. To act you must intend what you do. Animals do not intend to do what they do; they are purely re-active. Thus, you are morally responsible for the actions that you knowingly and willingly intend to happen. But with Big Data you are part of the aggregated active cause of the resulting targeting somewhere down the data road but without clear knowledge of the extent of your participation or its targeted use, or the outcome of what you partially initiated and caused. Thus, Zwitter asks to

what extent do data contributors (you and me) have moral responsibility for those targeted and possibly unjust outcomes?

Data is de-individualized in its aggregation which first distances the individual data contributor from a moral connection to her or his input and the consequent outcome impacting the targeted group. But impersonal data still retains group characteristics or it would be useless. Thus it does not matter that the data has been "de-individualized" because this anonymization still leaves group privacy vulnerable. Individual data contributors inevitably contribute to this group vulnerability and the use to which it is put, yet they no longer have any control of the outcome of this use and thus cannot have moral responsibility for it. In this way Zwitter thinks Big Data undermines or erodes personal moral responsibility.

In response to Zwitter, however, let me offer an alternative interpretation regarding his worry about the erosion of individual moral agency, a perspective that is born out of our earlier reflections in this course about the nature of human subjectivity. It may be that the potential undermining of individual moral agency resulting from the hyper-networked structure of a datified or data-driven social order is not an assault on moral agency but rather a necessary correction to the over-reach of the whole idea of moral agency to begin with, an idea we encountered earlier in this course.

To be a moral agent involves the presumption that we are somehow free of situational influences (free and autonomous) and thus able to make moral judgments for which we are entirely morally responsible. But this seemingly realistic position may have an erroneous assumption at the heart of the very idea of moral agency itself.

As we saw with the workers at Wells Fargo who were influenced by the toxic cross-selling culture that existed at the bank--and recalling again what Social Psychology teaches about invisible situational influences on our perception and judgments--it seems reasonable to conclude that the toxic culture influenced the moral judgments of the workers and is thus to some degree responsible for the workers' immoral behavior. Just as human subjectivity is essentially inter-subjectivity, according to Emmanuel Levinas, so also morality is perhaps always *inter-relational morality* such that we, as individuals, are never wholly and entirely responsible for any of our supposedly free and autonomous actions. In short, we are all in this together, inescapably. The idea of the separate individual is a myth not a reality.

So, from this inter-relational moral perspective, Big Data is not a threat to moral agency, as Zwitter thinks. Rather, Big Data (in addition to Social Psychology and Levinas, as well as some data from neuroscience) provides support for a critique of the individualist understanding of moral agency as an outmoded ideal configuration of the person based on a liberal notion of rational subjectivity that makes little sense in a hyper-connected social order. In other words, if it is true that we are all connected, as Levinas argues; and if it is true that our judgments are influenced by situational factors that we are unaware of, then we cannot be held absolutely individually accountable for our inter-related and contextualized 'actions'.

Could it be that there really is no such thing as an action of which I am wholly and entirely the cause? Are all actions necessarily inter-relational to some extent? What difference does this make to the assessment of moral responsibility? What do YOU think?

Video (2:15): How Big Data Can Win Elections

Note: Click on the above screen and then click "How Big Data Can Win Elections" in upper left-hand corner of next screen; or just use the hot link above.

A Review of Cathy O'Neil's Weapons of Math Destruction

Weapons of Math Destruction: How Big Data Destroys Lives [1]

Derek Beres

Derek Beres

A few weeks ago I went with my fiancée to buy a new car. While figuring out which model would be most economical, I reminded her to factor in an increase in insurance rates, something that had happened to me the previous year. The salesman said that might not be true.

Turns out he was right. A former auto insurance salesman, he told us rates are dependent upon zip code. Companies factor in the driving records of everyone in that neighborhood—your personal driving record is only partly consequential. So while moving from Mar Vista to Palms included an increase for me, my fiancée moving from Venice resulted in a decrease.

We should consider that balance, correct? Hardly. We're the victims of an invisible algorithm, something data scientist Cathy O'Neil spends an entire book discussing in *Weapons of Math Destruction*. A math geek by nature, O'Neil became disillusioned with her lifelong passion's applications in Big Data when working for a hedge fund during the economic collapse in 2008.

My insurance issue seems benign in comparison to many issues of inequality and injustice O'Neil address. To return to that industry, however, she discusses how credit scores, itself an industry fueled by deception and corruption, affects unsuspecting drivers in insidious ways.

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[1] Beres, Derek. "Weapons of Math Destruction: How Big Data Destroys Lives." Big Think, October 2016. http://bigthink.com/21st-century-spirituality/weapons-of-math-destruction-how-big-data-destroys-lives

For example, drivers in Florida with clean records and bad credit scores were shown to pay $1,522 *more* than drivers with similar records save a drunken driving conviction. Whether or not you've paid your phone bill can have more impact on auto insurance than getting hammered and sitting behind the wheel. If this seems unfair, it is, and the problems are only getting worse.

Credit scores are used by nearly half of American employers to screen potential employees. With the rise of online resume readers, qualified candidates are never considered by human eyes due to the slightest infraction. Yet credit should not be a prison sentence. Many factors contribute to a lapse in bill payment, including another subject invisible algorithms affect: health insurance. One crippling medical bill can very well result in punishment in the eyes of creditors and employers.

It's the invisibility, dehumanization by numbers, that's the real problem. Qualifying subtleties during an interview—facial expressions, vocal fluctuations, pantomimes, and perhaps most importantly, a logical explanation as to why one's credit score is not optimal—are never weighed in a system that only reads numerical data.

As an example O'Neil tells the story of Sarah Wysocki. In 2009, the Washington, D.C. school district implemented one such system to weed out ineffective teachers. Wysocki was beloved by parents but her IMPACT evaluation score placed her in the bottom 5 percent during the second year of statistical measuring. She was among the 206 teachers let go that year.

What such scoring systems do not take into account, O'Neil writes, are the nuanced factors of education. Like with corporations, the statistical machine seeks constant improvement in the same way shareholders demand perpetual profits. Yet teachers have different classes each year—she might instruct honors students one year, special education children the next. All the algorithm views are test results.

Another teacher in the book received a score of six out of a hundred in a similar rating method. The following year he received a ninety-six. While there's always room for improvement, such a system is obviously ineffective given such a wide disparity for a senior instructor. He was not alone on this absurd grading curve.

Day by day the rhythm of our lives are being automated. O'Neil has a special dislike for algorithms used by policing systems to monitor crime. They

create a self-perpetuating feedback loop targeting low-income minority neighborhoods. This leads to confirmation bias: *of course* that's where the problems are. Kids caught with nickel bags receive jail time while bankers siphoning billions from ignorant customers are immune to prosecution.

While critical of the systems in place, O'Neil reminds us that it does not have to be so. Math can be a tool of construction as well as destruction. For example, an algorithm could show if it's more beneficial to pay your phone or electricity bill during a tight month in regards to how each would affect your credit score. Not sexy, but realistic.

She calls for data scientists to take a digital Hippocratic Oath, which asks them to consider the enormous impact algorithms has on the population. She also wants companies to "open the hood" so methods are not hidden from public view.

Open source and numerically honest platforms are beneficial from consumer and social standpoints. O'Neil invokes Mitt Romney's 47 percent comment about Obama supporters "who pay no income tax." The presidential candidate believed himself to be in a room of like-minded elite, ignorant that staff might not share his values. When everyone's cell phone is a video camera politicians can no longer have separate talking points for separate audiences—something Hillary Clinton is being reminded of now thanks to Wikileaks.

Asking companies to peer behind the numbers is requesting of them an ethical consideration: Is it more important to maximize profits at inhumane costs or take a slight financial hit to serve the better good? Of course each is going to answer differently for a host of reasons. As long as that's the case we'll never know whether their weapons are constructive or destructive. As for now, the latter is too often true. As O'Neil warns, democracy itself is the wager.

Big Data and Moral Agency

Big Data ethics [2]

Andrej Zwitter

The speed of development in Big Data and associated phenomena, such as social media, has surpassed the capacity of the average consumer to understand his or her actions and their knock-on effects. We are moving towards changes in how ethics has to be perceived: away from individual decisions with specific and knowable outcomes, towards actions by many unaware that they may have taken actions with unintended consequences for anyone. Responses will require a rethinking of ethical choices, the lack thereof and how this will guide scientists, governments, and corporate agencies in handling Big Data. This essay elaborates on the ways Big Data impacts on ethical conceptions.

On 21 September 2012, a crowd of 3000 rioting people visited a 16-year-old girl's party at home in the little village of Haren, the Netherlands, after she had mistakenly posted a birthday party invite publicly on Facebook. Some might think that the biggest ethical and educational challenge that modern technology is posing concerns children. It seems, however, that particularly with the emergence of Big Data, ethicists have to reconsider some traditional ethical conceptions.

Since the onset of modern ethics in the late 18th century with Hume, Kant, Bentham, and Mills, we took premises such as individual moral responsibility for granted. Today, however, it seems Big Data requires ethics to do some rethinking of its assumptions, particularly about individual moral agency. The novelty of Big Data poses ethical difficulties (such as for privacy), which are not per se new.

These ethical questions, which are commonly known and understood, are also widely discussed in the media. For example, they resurface in the context of the

[2] Zwitter, Andrej. "Big Data Ethics." *Big Data and Society.* Sage, November 2014. https://doi.org/10.1177/2053951714559253

Snowden revelations and the respective investigations by The Guardian concerned with the capabilities of intelligence agencies. But its novelty would not be the sole reason for having to rethink how ethics works. In addition to its novelty, the very nature of Big Data has an underestimated impact on the individual's ability to understand its potential and make informed decisions. Hence, much less commonly discussed are the ethical implications of impersonal data. Examples include, among others, the "likes" on Facebook sold to marketing companies in order to more specifically target certain micro-markets; information generated out of Twitter feed based sentiment analyses for political manipulation of groups, etc.

This essay aims to underline how certain principles of our contemporary philosophy of ethics might be changing and might require a rethinking in philosophy, professional ethics, policy-making, and research. First, it will briefly outline the traditional ethical principles with regard to moral responsibility. Thereafter, it will summarize four qualities of Big Data with ethical relevance. The third delves deeper into the idea of the changing nature of power and the emergence of hyper-networked ethics; and the fourth section illustrates which ethical problems might emerge in society, politics and research due to these changes.

Traditional ethics

Since the enlightenment, traditional deontological and utilitarian ethics place a strong emphasis on moral responsibility of the individual, often also called moral agency (MacIntyre, 1998). This idea of moral agency very much stems from almost religiously followed assumptions about individualism and free will. Both these assumptions experience challenges when it comes to the advancement of modern technology, particularly Big Data. The degree to which an entity possesses moral agency determines the responsibility of that entity. Moral responsibility in combination with extraneous and intrinsic factors, which escape the will of the entity, defines the culpability of this entity. In general, the moral agency is determined by several entity innate conditions, three of which are commonly agreed upon (Norman, 2012):

1. Causality: An agent can be held responsible if the ethically relevant result is an outcome of its actions.
2. Knowledge: An agent can be blamed for the result of its actions if it had (or should have had) knowledge of the consequences of its actions.
3. Choice: An agent can be blamed for the result if it had the liberty to choose an alternative without greater harm for itself.

Implicitly, observers tend to exculpate agents if they did not possess full moral agency, i.e. when at least one of the three criteria is absent. There are, however, lines

of reasoning that consider morally relevant outcomes independently of the existence of a moral agency, at least in the sense that negative consequences establish moral obligations (Leibniz and Farrer, 2005; Pogge, 2002). New advances in ethics have been made in network ethics (Floridi, 2009), the ethics of social networking (Vallor, 2012), distributed and corporate moral responsibility (Erskine, 2004), as well as computer and information ethics (Bynum, 2011). Still, Big Data has introduced further changes, such as the philosophical problem of 'many hands', i.e. the effect of many actors contributing to an action in the form of distributed morality (Floridi, 2013; Noorman, 2012), which need to be raised.

Four moral qualities of Big Data

When recapitulating the core criteria of Big Data, it will become clear that the ethics of Big Data moves away from a personal moral agency in some instances. In other cases, it increases moral culpability of those that have control over Big Data. In general, however, the trend is towards an impersonal ethics based on consequences for others. Therefore, the key qualities of Big Data, as relevant for our ethical considerations, shall be briefly examined. At the heart of Big Data are four ethically relevant qualities:

1. There is more data than ever in the history of data:

- Beginning of recorded history till 2003—5 billion gigabytes
- 2011—5 billion gigabytes every two days
- 013—5 billion gigabytes every 10 min
- 2015—5 billion gigabytes every 10 s

2. Big Data is organic: although this comes with messiness, by collecting everything that is digitally available, Big Data represents reality digitally much more naturally than statistical data—in this sense it is much more organic. This messiness of Big Data is (among others, e.g. format inconsistencies and measurement artifacts) the result of a representation of the messiness of reality. It does allow us to get closer to a digital representation of reality.

3. *Big Data is potentially global:* not only is the representation of reality organic, with truly huge Big Data sets (like Google's) the reach becomes global in real time.

3. Correlations versus causation: Big data analyses emphasize correlations over causation.

Certainly, not all data potentially falling into the category of Big Data is generated by humans or concerns human interaction. The Sloan Digital Sky Survey in Mexico has generated 140 terabytes of data between 2000 and 2010. Its successor, the Large Synoptic Survey Telescope in Chile, when starting its work in 2016, will

collect as much within five days. There is, however, also a large spectrum of data that relates to people and their interaction directly or indirectly: social network data, the growing field of health tracking data, emails, text messaging, the mere use of the Google search engine, etc. This latter kind of data, even if it does not constitute the majority of Big Data, can, however, be ethically very problematic.

New power distributions

Ethicists constantly try to catch up with modern-day problems (drones, genetics, etc.) in order to keep ethics up-to-date. Many books on computer ethics and cyber ethics have been written in the past three decades since, among others, Johnson and Moor established the field. For Johnson, computer ethics "pose new versions of standard moral problems and moral dilemmas, exacerbating the old problems, and forcing us to apply ordinary moral norms in uncharted realms." This changes to some degree with Big Data as moral agency is being challenged on certain fundamental premises that most of the advancements in computer ethics took and still take for granted, namely free will and individualism. Moreover, in a hyperconnected era, the concept of power, which is so crucial for ethics and moral responsibility, is changing into a more networked fashion. Retaining the individual's agency, i.e. knowledge and ability to act, is one of the main challenges for the governance of socio-technical epistemic systems.

There are three categories of Big Data stakeholders: Big Data collectors, Big Data utilizers, and Big Data generators. Between the three, power is inherently relational in the sense of a network definition of power. In general, actor A's power is the degree to which B is dependent on A or alternatively A can influence B. That means that A's power is different vis-à-vis C. The more connections A has, the more power he or she can exert. This is referred to as micro-level power and is understood as the concept of centrality. On the macro-level, the whole network (of all actors A–B–C–D…) has an overall inherent power, which depends on the density of the network, i.e. the amount of edges between the nodes. In terms of Big Data stakeholders, this could mean that we find these new stakeholders wielding a lot of power:

1. Big Data collectors determine which data is collected, which is stored and for how long. They govern the collection, and implicitly the utility, of Big Data.

2. Big Data utilizers: They are on the utility production side. While (1) might collect data with or without a certain purpose, (2) (re-)defines the purpose for which data is used, for example regarding:

- Determining behavior by imposing new rules on audiences or manipulating social processes;

- Creating innovation and knowledge through bringing together new datasets, thereby achieving a competitive advantage.

3. Big Data generators:

- Natural actors that by input or any recording voluntarily, involuntarily, knowingly, or unknowingly generate massive amounts of data.
- Artificial actors that create data as a direct or indirect result of their task or functioning.
- Physical phenomena, which generate massive amounts of data by their nature or which are measured in such detail that it amounts to massive data flows.

The interaction between these three stakeholders illustrates power relationships and gives us already an entirely different view on individual agency, namely an agency that is, for its capability of morally relevant action, entirely dependent on other actors. One could call this agency 'dependent agency', for its capability to act is depending on other actors. Floridi refers to these moral enablers, which hinder or facilitate moral action, as "infraethics."

The network nature of society, however, means that this dependent agency is always a factor when judging the moral responsibility of the agent. In contrast to traditional ethics, where knock-on effects (that is, effects on third mostly unrelated parties, as for example in collateral damage scenarios) in a social or cause–effect network do play a minor role, Big Data-induced hyper-networked ethics exacerbate the effect of network knock-on effects. In other words, the nature of hyper-networked societies exacerbates the collateral damage caused by actions within this network. This changes foundational assumptions about ethical responsibility by changing what power is and the extent we can talk of free will by reducing knowable outcomes of actions, while increasing unintended consequences.

Some ethical Big Data challenges

When going through the four ethical qualities of Big Data above, the ethical challenges become increasingly clearer. Ads (1) and (2): as global warming is an effect of emissions of many individuals and companies, Big Data is the effect of individual actions, sensory data, and other real-world measurements creating a digital image of our reality; "datafication". Already, simply the absence of knowledge about which data is in fact collected or what it can be used for puts the "data generator" (e.g. online consumers, cellphone owning people, etc.) at an ethical disadvantage qua knowledge and free will. The "internet of things" further contributes to the distance between one actor's knowledge and will and the other actor's source of information

and power. Ad (3): global data leads to a power imbalance between different stakeholders benefitting mostly corporate agencies with the necessary know-how to generate intelligence and knowledge from information. Ad (4): like a true Delphian oracle, Big Data correlations suggest causations where there might be none. We become more vulnerable to having to believe what we see without knowing the underlying whys.

Privacy

The more our lives become mirrored in a cyber reality and recorded, the more our present and past become almost completely transparent for actors with the right skills and access (Beeger, 2013). The Guardian revealed that Raytheon (a US defense contractor) developed the Rapid Information Overlay Technology (RIOT) software, which uses freely accessible data from social networks and data associated with an IP address, etc., to profile one person and make their everyday actions completely transparent (The Guardian, 2013a).

Group privacy

Data analysts are using Big Data to find out our shopping preferences, health status, sleep cycles, moving patterns, online consumption, friendships, etc. In only a few cases, and mostly in intelligence circles, this information is individualized. De-individualization (i.e. removing elements that allow data to be connected to one specific person) is, however, just one aspect of anonymization. Location, gender, age, and other information relevant for the belongingness to a group and thus valuable for statistical analysis relate to the issue of group privacy.

Anonymization of data is, thus, a matter of degree of how many and which group attributes remain in the data set. To strip data from all elements pertaining to any sort of group belongingness would mean to strip it from its content. In consequence, despite the data being anonymous in the sense of being de-individualized, groups are always becoming more transparent. This issue was already raised by Dalenius (1977) for statistical databases and later by Dwork (2006) that "nothing about an individual should be learnable from the database that cannot be learned without access to the database". This information gathered from statistical data and increasingly from Big Data can be used in a targeted way to get people to consume or to behave in a certain way, e.g. through targeted marketing.

Furthermore, if different aspects about the preferences and conditions of a specific group are known, these can be used to employ incentives to encourage or discourage a certain behavior. For example, knowing that group A has a preference α (e.g. ice cream) and a majority of the same group has a condition β (e.g. being undecided about which party to vote for), one can provide α for this group to behave in the domain of β in a specific way by creating a conditionality (e.g. if one votes for

party B one gets ice cream). This is standard party politics; however, with Big Data the ability to discover hidden correlations increases, which in turn increases the ability to create incentives whose purposes are less transparent.

Conversely, hyper-connectivity also allows for other strategies, e.g. bots which infiltrate Twitter (the so-called Twitter bombs) are meant to create fake grass-roots debates about, for example, a political party that human audiences also falsely perceive as legitimate grassroots debates. This practice is called "Astroturfing" and is prohibited by Twitter policies, which, however, does not prevent political campaigners from doing it. The electoral decision between Coakley and Brown (in favor of the Republican Brown) of the 2010 special election in Massachusetts to fill the Senate seat formerly held by Ted Kennedy might have been decided by exactly such a bot, which created a Twitter smear campaign in the form of a fake public debate (Ehrenberg, 2012). A 2013 report showed that in fact 61.5% of website visitors were bots (with an increasing tendency). Half of this traffic consisted of "good bots" necessary for search engines and other services, the other half consisted of malicious bot types such as scrapers (5%), hacking tools (4.5%), spammers (0.5%), and impersonators (20.5%) for the purpose of market intelligence and manipulation (Zeifman, 2013).

Propensity

The movie *Minority Report* painted a vision of a future in which predictions about what people were likely to do could lead to their incarceration without an act committed. While the future might not be as bad as depicted in the movie, "predictive policing" is already a fact in cities like Los Angeles, where Big Data analytics point to certain streets, gangs or individuals, who are more likely to commit a crime, in order to have them subjected to extra surveillance.\

The problem is very much a political one: the high probability of a certain person committing a murder cannot be ignored without major public criticism if nothing had been done to prevent it. Another example puts the stakes somewhat lower: what if Big Data analytics predict that a certain person (e.g. a single parent living in a certain neighborhood, with no job, a car, no stable relationship, etc.) has a likelihood of 95% to be involved in domestic violence? No social welfare organization having such information would politically be able not to act on such information. Sending social workers to the person's house might not be as invasive as incarcerating people before the deed and it also does not violate the presumption of innocence. However, this might cause a stigma on the person, the family, and friends. Furthermore, this raises questions about the ethical role of those setting the intervention threshold and the data scientists writing the algorithm that calculates the chance based on certain variables available in the Big Data pool.

One of the key changes in Big Data research is that data scientists let algorithms search for correlations themselves. This can often lead to surprise findings, e.g. the very famous Wal-Mart finding of increased Pop-Tart purchases before hurricanes (Hays, 2004). When searching for random commonalities (through data mining), it can be concluded/suggested that the more data we have, the more commonalities we are bound to find. Big data makes random connectedness on the basis of random commonalities extremely likely. In fact, no connectedness at all would be the outlier. This, in combination with social network analysis, might yield information that is not only highly invasive into one's privacy, but can also establish random connections based on incidental co-occurrences. In other words, Big Data makes the likelihood of random findings bigger—something that should be critically observed with regard to investigative techniques such as RIOT.

Research ethics

Ethical codes and standards with regard to research ethics lag behind this development. While in many instances research ethics concerns the question of privacy, the use of social media such as Twitter and Facebook for research purposes, even in anonymous form, remains an open question. On the one hand, Facebook is the usual suspect to be mentioned when it comes to questions of privacy. At the same time, this discussion hides the fact that a lot of non-personal information can also reveal much about very specific groups in very specific geographical relations. In other words, individual information might be interesting for investigative purposes of intelligence agencies, but the actually valuable information for companies does not require the individual tag. This is again a problem of group privacy.

The same is true for research ethics. Many ethical research codes do not yet consider the non-privacy-related ethical effect (see, for example, BD&S' own statement "preserving the integrity and privacy of subjects participating in research"). Research findings that reveal uncomfortable information about groups will become the next hot topic in research ethics, e.g. researchers who use Twitter are able to tell uncomfortable truths about specific groups of people, potentially with negative effects on the researched group. Another problem is the "informed consent": despite the data being already public, no one really considers suddenly being the subject of research in Twitter or Facebook studies. However, in order to represent and analyze pertinent social phenomena, some researchers collect data from social media without considering that the lack of informed consent would in any other form of research (think of psychological or medical research) constitute a major breach of research ethics.

Conclusions

Does Big Data change everything, as Cukier and Mayer-Schönberger have proclaimed? This essay tried to indicate that Big Data might induce certain changes to traditional assumptions of ethics regarding individuality, free will, and power. This might have consequences in many areas that we have taken for granted for so long.

In the sphere of education, children, adolescents, and grown-ups still need to be educated about the unintended consequences of their digital footprints (beyond digital literacy). Social science research might have to consider this educational gap and draw its conclusions about the ethical implications of using anonymous, social Big Data, which nonetheless reveals much about groups. In the area of law and politics, I see three likely developments:

1. political campaign observers, think tank researchers, and other investigators will increasingly become specialized data forensic scientists in order to investigate new kinds of digital manipulation of public opinion;
2. law enforcement and social services as much as lawyers and legal researchers will necessarily need to re-conceptualize individual guilt, probability and crime prevention; and
3. states will progressively redesign the way they develop their global strategies based on global data and algorithms rather than regional experts and judgment calls.

When it comes to Big Data ethics, it seems not to be an overstatement to say that Big Data does have strong effects on assumptions about individual responsibility and power distributions. Eventually, ethicists will have to continue to discuss how we can and how we want to live in a 'datafied' world and how we can prevent the abuse of Big Data as a new found source of information and power.

A Pew Research survey of Big Data experts

Code-Dependent: Pros and Cons of the Algorithm Age[3]
Lee Rainie and Janna Anderson

Algorithms are aimed at optimizing everything. They can save lives, make things easier, and conquer chaos. Still, experts worry they can also put too much control in the hands of corporations and governments, perpetuate bias, create filter bubbles, cut choices, creativity and serendipity, and could result in greater unemployment.

[3] Rainie, Lee and Janna Anderson, "Code-Dependent: Pros and Cons of the Algorithm Age." Pew Research Center, February 2017. http://www.pewinternet.org/2017/02/08/code-dependent-pros-and-cons-of-the-algorithm-age

Algorithms are instructions for solving a problem or completing a task. Recipes are algorithms, as are math equations. Computer code is algorithmic. The internet runs on algorithms and all online searching is accomplished through them. Email knows where to go thanks to algorithms. Smartphone apps are nothing but algorithms. Computer and video games are algorithmic storytelling. Online dating and book-recommendation and travel websites would not function without algorithms. GPS mapping Systems get people from point A to point B vía algorithms. Artificial intelligence (AI) is naught but algorithms. The material people see on social media is brought to them by algorithms. In fact, everything people see and do on the web is a product of algorithms. Every time someone sorts a column in a spreadsheet, algorithms are at play, and most financial transactions today are accomplished by algorithms. Algorithms help gadgets respond to voice commands, recognize faces, sort photos and build and drive cars. Hacking, cyberattacks, and cryptographic code-breaking exploit algorithms. Self-learning and self-programming algorithms are now emerging, so it is possible that in the future algorithms will write many if not most algorithms.

Algorithms are often elegant and incredibly useful tools used to accomplish tasks. They are mostly invisible aids, augmenting human Lives in increasingly incredible ways. However, sometimes the application of algorithms created with good intentions leads to unintended consequences. Recent news Items tie to these concerns:

- The British pound dropped 6.1% in value in seconds on Oct. 7. 2016. Partly because of currency trades triggered by algorithms.
- Microsoft engineers created a Twitter bot named “Tay” this past spring in an attempt to chat with Millennials by responding to their prompts, but within hour’s ft was spouting racist. sexist. Holocaust-denying tweets based on algorithms that had it “learning” how to respond to others based on what was tweeted at it.
- Facebook tried to create a feature to highlight Trending Topics from around the site in people’s feeds. First, it had a team of humans edit the feature. But controversy erupted when some accused the platform of being biased against conservatives. So, Facebook then turned the job over to algorithms only to find that they could not discern real news from fake news.
- Cathy O’Neil, author of *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*, pointed out that predictive analytics based on algorithms tend to punish the poor. Using algorithmic hiring practices as an example.
- Well-intentioned algorithms can be sabotaged by bad actors. An internet slowdown swept the East Coast of the U.S. On Oct. 21, 2016, after hackers bombarded Din DNS, an internet traffic handler, with information that overloaded its circuits, ushering in a new era of internet attacks powered by internet-connected devices.

This after internet security expert Bruce Schneier warned in September that "Someone Is Learning How to take down the Internet." And the abuse of Facebook's News Feed algorithm and general promulgation of fake news online became controversial as the 2016 U.S. Presidential election proceeded.

- Researcher Andrew Tutt called for an "FDA for Algorithms." noting, "The rise of increasingly complex algorithms calls for critical thought about how to best prevent, deter and compensate for the harms that they cause .... Algorithmic regulation will require federal uniformity, expert judgment, political independence, and pre-market review to prevent - without stifling innovation - the introduction of unacceptably dangerous algorithms into the market."
- The White House released two reports in October 2016 detailing the advance of algorithms and artificial intelligence and plans to address issues tied to it. And it issued a December report outlining some of the potential effects of Al-driven automation on the U.S. Job market and economy.
- On January 17, 2017, the Future of Life Institute published a list of 23 Principles for Beneficial Artificial Intelligence. Created by a gathering of concerned researchers at a conference at Asimolar, in Pacific Grove, California. The more than 1,600 signatories included Steven Hawking, Elon Musk, Ray Kurzweil, and hundreds of the world's foremost AI researchers.

The use of algorithms is spreading as massive amounts of data are being created, captured, and analyzed by businesses and governments. Some are calling this the Age of Algorithms and predicting that the future of algorithms is tied to machine learning and deep learning that will get better and better at an ever-faster pace.

While many of the 2016 U.S. Presidential election post-mortems noted the revolutionary impact of web-based tools in influencing its outcome, XPrize Foundation CEO Peter Diamandis predicted, "Five big tech trends will make this election look tame." He said advances in quantum computing and the rapid evolution of AI and AI agents embedded in systems and devices in the Internet of Things will lead to hyper-stalking, influencing and shaping of voters, and hyper- personalized ads, and will create new ways to misrepresent reality and perpetuate falsehoods.

Seven major themes about the algorithm era

Theme 1 Algorithms will continue to spread everywhere

- The benefits will be visible and invisible and can lead to greater human insight into the world
- The many upsides of algorithms are accompanied by challenges

Theme 2 Good things lie ahead

- Data-driven approaches to problem-solving will expand
- Code processes will be refined and improved; ethical issues are being worked out
- "Algorithms don't have to be perfect; they just have to be better than people"
- In the future, the world may be governed by benevolent Al

Theme 3 Humanity and human judgment are lost when data and predictive modeling become paramount

- Programming primarily in pursuit of profits and efficiencies is a threat
- Algorithms manipulate people and outcomes, and even "read our minds"
- All of this will lead to a flawed yet inescapable logic-driven society
- Some fear people could lose sophisticated decision-making capabilities and local intelligence
- As code takes over complex systems, humans are left out of the loop
- Solutions should include embedding respect for the individual

Theme 4 Biases exist in algorithmically-organized systems

- Algorithms reflect the biases of programmers and datasets
- Algorithms depend upon data that is often limited, deficient or incorrect

Theme 5 Algorithmic categorizations deepen divides

- The disadvantaged are likely to be even more so
- Algorithms create filter bubbles and silos shaped by corporate data collectors. They limit people's exposure to a wider range of ideas and reliable information and eliminate serendipity

Theme 6 Unemployment will rise

- Smarter, more-efficient algorithms will displace many human work activities
- Some seek a redefined global economic system to support humanity

Theme 7 The need grows for algorithmic literacy, transparency and oversight

- It starts with algorithm literacy - this goes beyond basic digital literacy
- People call for accountability processes, oversight and transparency
- Many are pessimistic about the prospects for policy rules and oversight

Analysts foresee algorithms taking over public and private activities in a new era of "algocratic governance" that supplants "bureaucratic hierarchies." Others describe the emergence of "surveillance capitalism" that organizes economic behavior in an "information civilization."

The Survey

To illuminate current attitudes about the potential impacts of algorithms in the next decade, Pew Research Center and Elon University's Imagining the Internet Center conducted a large-scale canvassing of technology experts, scholars, corporate practitioners, and government leaders. Some 1,302 responded to this question about what will happen in the next decade:

Will the net overall effect of algorithms be positive for individuals and society or negative for individuals and society?

The non-scientific canvassing found that 38% of these particular respondents predicted that the positive impacts of algorithms will outweigh negatives for individuals and society in general, while 37% said negatives will outweigh positives; 25% said the overall impact of algorithms will be about 50-50, positive-negative. [See "About this canvassing of experts" for further details about the limits of this sample.]

Participants were asked to explain their answers, and most wrote detailed elaborations that provide insights about hopeful and concerning trends. Respondents were allowed to respond anonymously; these constitute a slight majority of the written elaborations. These findings do not represent all the points of view that are possible to a question like this, but they do reveal a wide range of valuable observations based on current trends.

In the next section we offer a brief outline of seven key themes found among the written elaborations. Following that introductory section there is a much more in-depth look at respondents' thoughts tied to each of the themes, beginning on page 20 of this report. All responses are lightly edited for style.

Theme 1: Algorithms will continue to spread everywhere

There is fairly uniform agreement among these respondents that algorithms are generally invisible to the public and there will be an exponential rise in their influence in the next decade.

A representative statement of this view carne from Barry Chudakov, founder and principal at Sertain Research and Stream Fuzion Corp. He replied:

"If every algorithm suddenly stopped working, it would be the end of the world as we know it.' (Pedro Domingo's The Master Algorithm). Fact: We have already turned our world over to machine learning and algorithms. The question now is how to better understand and manage what we have done?

"Algorithms are a useful artifact to begin discussing the larger issue of the effects of technology-enabled assists in our lives. Namely, how can we see them at work? Consider and assess their assumptions? And most importantly for those who

don't create algorithms for a living - how do we educate ourselves about the way they work, where they are in operation, what assumptions and biases are inherent in them, and how to keep them transparent? Like fish in a tank, we can see them swimming around and keep an eye on them.

"Algorithms are the new arbiters of human decision-making in almost any area we can imagine, from watching a movie (Affective emotion recognition) to buying a house (Zillow.com) to self-driving cars (Google). Deloitte Global predicted more than 8o of the world's two largest enterprise software companies will have cognitive technologies - mediated by algorithms - integrated into their products by the end of 2016. As Brian Christian and Tom Griffiths write in Algorithms to Live By, algorithms provide 'a better standard against which to compare human cognition itself.' They are also a goad to consider that same cognition: How are we thinking and what does it mean to think through algorithms to mediate our world?

"The main positive result of this is better understanding of how to make rational decisions, and in this measure a better understanding of ourselves. After all, algorithms are generated by trial and error, by testing, by observing, and coming to certain mathematical formulae regarding choices that have been made again and again - and this can be used for difficult choices and problems, especially when intuitively we cannot readily see an answer or a way to resolve the problem. The 37% Rule. Optimal stopping and other algorithmic conclusions are evidence-based guides that enable us to use wisdom and mathematically verified steps to make better decisions.

"The secondary positive result is connectivity. In a technological recapitulation of what spiritual teachers have been saying for centuries, our things are demonstrating that everything is - or can be - connected to everything else. Algorithms with the persistence and ubiquity of insects will automate processes that used to require human manipulation and thinking. These can now manage basic processes of monitoring, measuring, counting, or even seeing. Our car can tell us to slow down. Our televisions can suggest movies to watch. A grocery can suggest a healthy combination of meats and vegetables for dinner. Siri reminds you it's your anniversary.

"The main negative changes come down to a simple but now quite difficult question: How can we see, and fully understand the implications of, the algorithms programmed into everyday actions and decisions? The rub is this: Whose intelligence is it, anyway? ... Our Systems do not have, and we need to build in, what David Gelernter called 'topsight.' the ability to not only create technological Solutions but also see and explore their consequences before we build business models, companies and markets on their strengths, and especially on their limitations."

Chudakov added that this is especially necessary because in the next decade and beyond, "By expanding collection and analysis of data and the resulting application of this information, a layer of intelligence or thinking manipulation is added to processes and objects that previously did not have that layer. So prediction possibilities follow us around like a pet. The result: As information tools and predictive dynamics are more widely adopted, our lives will be increasingly affected by their inherent conclusions and the narratives they spawn."

"The overall impact of ubiquitous algorithms is presently incalculable because the presence of algorithms in everyday processes and transactions is now so great, and is mostly hidden from public view. All of our extended thinking systems (algorithms fuel the software and connectivity that create extended thinking systems) demand more thinking - not less - and a more global perspective than we have previously managed. The expanding collection and analysis of data and the resulting application of this information can cure diseases, decrease poverty, bring timely Solutions to people and places where need is greatest, and dispel millennia of prejudice, ill-founded conclusions, inhumane practice and ignorance of all kinds. Our algorithms are now redefining what we think, how we think, and what we know. We need to ask them to think about their thinking - to look out for pitfalls and inherent biases before those are baked in and harder to remove.

"To create oversight that would assess the impact of algorithms, first we need to see and understand them in the context for which they were developed. That, by itself, is a tall order that requires impartial experts backtracking through the technology development process to find the models and formulae that originated the algorithms. Then, keeping all that learning at hand, the experts need to soberly assess the benefits and deficits or risks the algorithms create. Who is prepared to do this? Who has the time, the budget, and resources to investigate and recommend useful courses of action? This is a 2ist-century job description - and market niche - in search of real people and companies. In order to make algorithms more transparent, products and product information circular might include an outline of algorithmic assumptions, akin to the nutritional sidebar now found on many packaged food products, that would inform users of how algorithms drive intelligence in a given product and a reasonable outline of the implications inherent in those assumptions."

Theme 2: Good things lie ahead

A number of respondents noted the many ways in which algorithms will help make sense of massive amounts of data, noting that this will spark breakthroughs in science, new conveniences, and human capacities in everyday life, and an ever-better capacity to link people to the information that will help them. They perform seemingly miraculous tasks humans cannot and they will continue to greatly augment

human intelligence and assist in accomplishing great things. A representative proponent of this view is Stephen Downes, a researcher at the National Research Council of Canada, who listed the following as positive changes:

Banks. Today banks provide loans based on very incomplete data. It is true that many people who today qualify for loans would not get them in the future. However, many people - and arguably many more people - will be able to obtain loans in the future, as banks turn away from using such factors as race, socio-economic background, postal code and the like to assess fit. Moreover, with more data (and with a more Interactive relationship between bank and client) banks can reduce their risk, thus providing more loans, while at the same time providing a range of Services individually directed to actually help a person's financial State.

"*Health care providers.* Health care is a significant and growing expense not because people are becoming less healthy (in fact, society-wide, the opposite is true) but because of the significant overhead required to support increasingly complex Systems, including prescriptions, insurance, facilities and more. New technologies will enable health providers to shift a significant percentage of that load to the individual, who will (with the aid of personal support Systems) manage their health better, coordinate and manage their own care, and create less of a burden on the system. As the overall cost of health care declines, it becomes increasingly feasible to provide single-payer health insurance for the entire population, which has known beneficial health outcomes and efficiencies.

"*Governments.* A significant proportion of government is based on regulation and monitoring, which will no longer be required with the deployment of automated production and transportation Systems, along with sensor networks. This includes many of the daily (and often unpleasant) interactions we have with government today, from traffic offenses, manifestation of civil discontent, unfair treatment in commercial and legal processes, and the like. A simple example: One of the most persistent political problems in the United States is the gerrymandering of political boundaries to benefit incumbents. Electoral divisions created by an algorithm to a large degree eliminate gerrymandering (and when open and debatable, can be modified to improve on that result)."

A sampling of additional answers, from anonymous respondents:

- "Algorithms find knowledge in an automated way much faster than traditionally feasible."
- "Algorithms can crunch databases quickly enough to alleviate some of the red tape and bureaucracy that currently slows progress down."
- "We will see less pollution, improved human health, less economic waste."
- "Algorithms have the potential to equalize access to information."

- "The efficiencies of algorithms will lead to more creativity and self-expression."
- "Algorithms can diminish transportation issues; they can identify congestion and alternative times and paths."
- "Self-driving cars could dramatically reduce the number of accidents we have per year, as well as improve quality of life for most people."
- "Better-targeted delivery of news, Services, and advertising."
- "More evidence-based social Science using algorithms to collect data from social media and click trails."
- "Improved and more proactive police work, targeting areas where crime can be prevented. "
- "Fewer underdeveloped areas and more international commercial exchanges."
- "Algorithms ease the friction in decision-making, purchasing, transportation and a large number of other behaviors."
- "Bots will follow orders to buy your stocks. Digital agents will find the materials you need."
- "Any errors could be corrected. This will mean the algorithms only become more efficient to humanity's desires as time progresses."

Themes illuminating concerns and challenges

Participants in this study were in substantial agreement that the abundant positives of accelerating code-dependency will continue to drive the spread of algorithms; however, as with all great technological revolutions, this trend has a dark side. Most respondents pointed out concerns, chief among them the final five overarching themes of this report; all have subthemes.

Theme 3: Humanity and human judgment are lost when data and predictive modeling become paramount

Advances in algorithms are allowing technology corporations and governments to gather, store, sort and analyze massive data sets. Experts in this canvassing noted that these algorithms are primarily written to optimize efficiency and profitability without much thought about the possible societal impacts of the data modeling and analysis. These respondents argued that humans are considered to be an "input" to the process and they are not seen as real, thinking, feeling, changing beings. They say this is creating a flawed, logic-driven society and that as the process evolves - that is, as algorithms begin to write the algorithms - humans may get left out of the loop, letting "the robots decide." Representative of this view:

Bart Knijnenburg, assistant professor in human-centered computing at Clemson University, replied, "Algorithms will capitalize on convenience and profit, thereby discriminating [against] certain populations, but also eroding the experience

of everyone else. The goal of algorithms is to fit some of our preferences, but not necessarily all of them: They essentially present a caricature of our tastes and preferences. My biggest fear is that, unless we tune our algorithms for self-actualization, it will be simply too convenient for people to follow the advice of an algorithm (or, too difficult to go beyond such advice), turning these algorithms into self-fulfilling prophecies, and users into zombies who exclusively consume easy-to-consume items."

An anonymous futurist said, "This has been going on since the beginning of the industrial revolution. Every time you design a human system optimized for efficiency or profitability you dehumanize the workforce. That dehumanization has now spread to our health care and social Services. When you remove the humanity from a system where people are included, they become victims."

Another anonymous respondent wrote, "We simply can't capture every data element that represents the vastness of a person and that person's needs, wants, hopes, desires. Who is collecting what data points? Do the human beings the data points reflect even know or did they just agree to the terms of Service because they had no real choice? Who is making money from the data? How is anyone to know how his/her data is being massaged and for what purposes to justify what ends? There is no transparency, and oversight is a farce. It's all hidden from view. I will always remain convinced the data will be used to enrich and/or protect others and not the individual. It's the basic nature of the economic system in which we live."

A sampling of excerpts tied to this theme from other respondents:

- "The potential for good is huge, but the potential for misuse and abuse - intentional, and inadvertent - maybe greater."
- "Companies seek to maximize profit, not maximize societal good. Worse, they repackage profit-seeking as a societal good. We are nearing the crest of a wave, the trough side of which is a new ethics of manipulation, marketing, nearly complete lack of privacy."
- "What we see already today is that, in practice, stuff like 'differential pricing' does not help the consumer; it helps the company that is selling things, etc."
- "Individual human beings will be herded around like cattle, with predictably destructive results on rule of law, social justice, and economics."
- "There is an incentive only to further obfuscate the presence and operations of algorithmic shaping of Communications processes."
- "Algorithms are ... amplifying the negative impacts of data gaps and exclusions."
- "Algorithms have the capability to shape individuals' decisions without them even knowing it, giving those who have control of the algorithms an unfair position of power."

- "The fact the internet can, through algorithms, be used to almost read our minds means [that] those who have access to the algorithms and their databases have a vast opportunity to manipulate large population groups."
- "The lack of accountability and complete opacity is frightening."
- "By utilitarian metrics, algorithmic decision-making has no downside; the fact that it results in perpetual injustices toward the very minority classes it creates will be ignored. The Common Good has become a discredited, obsolete relic of The Past."
- "In an economy increasingly dominated by a tiny, very privileged, and insulated portion of the population, it will largely reproduce inequality for their benefit. Criticism will be belittled and dismissed because of the veneer of digital 'logic' over the process."
- "Algorithms are the new gold, and it's hard to explain why the average 'good' is at odds with the individual 'good.'"
- "We will interpret the negative individual impact as the necessary collateral damage of 'progress.'"
- "This will kill local intelligence, local skills, minority languages, local entrepreneurship because most of the available resources will be drained out by the global competitors."
- "Algorithms in the past have been created by a programmer. In the future they will likely be evolved by intelligent/learning machines.... Humans will lose their agency in the world."
- "It will only get worse because there's no 'crisis' to respond to, and hence, not only no motivation to change, but every reason to keep it going - especially by the powerful interests involved. We are heading for a nightmare."
- "Web 2.0 provides more convenience for citizens who need to get a ride home, but at the same time - and it's naive to think this is a coincidence - it's also a monetized, corporatized, disempowering, cannibalizing harbinger of the End Times. (I exaggerate for effect. But not by much.)"

Theme 4: Biases exist in algorithmically-organized systems

Two strands of thinking tie together here. One is that the algorithm creators (code writers), even if they strive for inclusiveness, objectivity and neutrality, build into their creations their own perspectives and values. The other is that the datasets to which algorithms are applied have their own limits and deficiencies. Even datasets with billions of pieces of information do not capture the fullness of people's lives and the diversity of their experiences. Moreover, the datasets themselves are imperfect because they do not contain inputs from everyone or a representative sample of everyone. The two themes are advanced in these answers:

Justin Reich, executive director at the MIT Teaching Systems Lab, observed, "The algorithms will be primarily designed by white and Asian men - with data selected by these same privileged actors - for the benefit of consumers like themselves. Most people in positions of privilege will find these new tools convenient, safe and useful. The harms of new technology will be most experienced by those already disadvantaged in society, where advertising algorithms offer bail bondsman ads that assume readers are criminals, loan applications that penalize people for proxies so correlated with race that they effectively penalize people based on race, and similar issues."

Dudley Irish, a software engineer, observed, "All, let me repeat that, all of the training data contains biases. Much of it either racial- or class-related, with a fair sprinkling of simply punishing people for not using a standard dialect of English. To paraphrase Immanuel Kant, out of the crooked timber of these datasets no straight thing was ever made."

A sampling of quote excerpts tied to this theme from other respondents:

- "Algorithms are, by definition, impersonal and based on gross data and generalized assumptions. The people writing algorithms, even those grounded in data, are a non-representative subset of the population."
- "If you start at a place of inequality and you use algorithms to decide what is a likely outcome for a person/system, you inevitably reinforce inequalities."
- "We will all be mistreated as more homogenous than we are."
- "The result could be the institutionalization of biased and damaging decisions with the excuse of, 'The Computer made the decision, so we have to accept it.'"
- "The algorithms will reflect the biased thinking of people. Garbage in, garbage out. Many dimensions of life will be affected, but few will be helped. Oversight will be very difficult or impossible."
- "Algorithms value efficiency over correctness or fairness, and over time their evolution will continue the same priorities that initially formulated them."
- "One of the greatest challenges of the next era will be balancing protection of intellectual property in algorithms with protecting the subjects of those algorithms from unfair discrimination and social engineering."
- "Algorithms purport to be fair, rational and unbiased but just enforce prejudices with no recourse."
- "Unless the algorithms are essentially open source and as such can be modified by user feedback in some fair fashion, the power that likely algorithm-producers (corporations and governments have to make choices favorable to themselves, whether in internet terms of s ervice or adhesion contracts or political biases, will inject both conscious and unconscious bias into algorithms."

Theme 5: Algorithmic categorizations deepen divides

Two connected ideas about societal divisions were evident in many respondents' answers. First, they predicted that an algorithm-assisted future will widen the gap between the digitally savvy (predominantly the most well-off, who are the most desired demographic in the new information ecosystem) and those who are not nearly as connected or able to participate. Second, they said social and political divisions will be abetted by algorithms, as algorithm-driven categorizations and classifications steer people into echo chambers of repeated and reinforced media and political content. Two illustrative answers:

Ryan Hayes, owner of Fit to Tweet, commented, "Twenty years ago we talked about the 'digital divide' being people who had access to a Computer at home vs. those that didn't, or those who had access to the internet vs. those who didn't.... Ten years from now, though, the life of someone whose capabilities and perception of the world is augmented by sensors and processed with powerful AI and connected to vast amounts of data is going to be vastly different from that of those who don't have access to those tools or knowledge of how to utilize them. And that divide will be self-perpetuating, where those with fewer capabilities will be more vulnerable in many ways to those with more."

Adam Gismondi, a visiting scholar at Boston College, wrote, "I am fearful that as users are quarantined into distinct ideological areas, human capacity for empathy may suffer. Brushing up against contrasting viewpoints challenges us, and if we are able to (actively or passively) avoid others with different perspectives, it will negatively impact our society. It will be telling to see what features our major social media companies add in coming years, as they will have tremendous power over the structure of information flow."

Theme 6: Unemployment will rise

The spread of artificial intelligence (AI) has the potential to create major unemployment and all the fallout from that.

An anonymous CEO said, "If a task can be effectively represented by an algorithm, then it can be easily performed by a machine. The negative trend I see here is that - with the rise of the algorithm - humans will be replaced by machines/computers for many jobs/tasks. What will then be the fate of Man?"

Theme 7: The need grows for algorithmic literacv, transparency and oversight

The respondents to this canvassing offered a variety of ideas about how individuals and the broader culture might respond to the algorithmization of life. They argued for public education to instill literacy about how algorithms function in

the general public. They also noted that those who create and evolve algorithms are not held accountable to society and argued there should be some method by which they are. Representative comments:

Susan Etlinger, industry analyst at Altimeter Group, said, "Much like the way we increasingly wish to know the place and under what conditions our food and clothing are made, we should question how our data and decisions are made as well. What is the supply chain for that information? Is there clear stewardship and an audit trail? Were the assumptions based on partial information, flawed sources, or irrelevant benchmarks? Did we train our data sufficiently? Were the right stakeholders involved, and did we learn from our mistakes? The upshot of all of this is that our entire way of managing organizations will be upended in the next decade. The power to create and change reality will reside in technology that only a few truly understand. So to ensure that we use algorithms successfully, whether for financial or human benefit or both, we need to have governance and accountability structures in place. Easier said than done, but if there were ever a time to bring the smartest minds in industry together with the smartest minds in academia to solve this problem, this is the time."

Chris Kutama, author of Age of Discovery and fellow at the Oxford Martin School, wrote, "Algorithms are an explicit form of heuristic, a way of routinizing certain choices and decisions so that we are not constantly drinking from a fire hydrant of sensory inputs. That coping strategy has always been co-evolving with humanity, and with the complexity of our social Systems and data environments. Becoming explicitly aware of our simplifying assumptions and heuristics is an important site at which our intellects and influence mature. What is different now is the increasing power to program these heuristics explicitly, to perform the simplification outside of the human mind and within the machines and platforms that deliver data to billions of individual lives. It will take us some time to develop the wisdom and the ethics to understand and direct this power. In the meantime, we honestly don't know how well or safely it is being applied. The first and most important step is to develop better social awareness of who, how, and where it is being applied."

Yuval Harari, author of *Sapiens: A Brief History of Humankind*, and, more recently, *Homo Deus: A Brief History of Tomorrow,* makes the case that the human race, guided to present glory by collective 'fictions' like myth, religion, and freedom, will be guided into the future by the new god called Dataism in the Age of Algorithms. This could take the human race far, especially in health care and transportation, but could also result in depersonalization, loss of privacy and autonomy, and uselessness.

PRACTICE

Reflection Exercise

Describe three ways that algorithms can result in unjust predictions as this was discussed by Cathy O'Neil in one of the readings and one of the videos for this week. What does she suggest as a solution for this problem? (Hint: she calls it an "algorithm audit") How do you think that the problem of algorithms containing biases should be dealt with? Should algorithms be regulated?

FURTHER READING

Challenges for the security of big data analytics (May 9, 2019)

Big Data Trends in 2019 (May 9, 2019)

Three reasons your company dislikes Big Data and 4 things you can do about it (May 8, 2019)

Five Ways Big Data Can Help Your Business Succeed (May 6, 2019)