Metaphors We Nudge By: Reflections on the Impact of Predictive Algorithms on our Self-understanding

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Metaphors of the Human

Humans are unfathomable beings. This applies not only to the actions and motives of others, but also to ourselves. Or, as Friedrich Nietzsche formulates it the preface of *Genealogy of Morality* (1887): "We knowers, we are unknown to ourselves. [...] We remain strange to ourselves out of necessity" (Nietzsche 2006, 3). That sounds counterintuitive. Of all things,

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aren't we the most familiar with ourselves? That may be so, but to think that this leads to self-knowledge is, according to Nietzsche, the mother of all errors. In the second edition of his *The Gay Science*, also published in 1887, Nietzsche explains why this is the case: "The familiar is what we are used to, and what we are used to is the most difficult to 'know'—that is, to view as a problem, to see as strange, as distant, as 'outside us' …" (Nietzsche 2002, 215). Is that problematic character of self-knowledge why, in our attempts to understand ourselves, we have traditionally compared ourselves with and distinguished ourselves from beings that lie outside of us and which fundamentally differ from us, such as immortal gods and animals? Since the rise of modern technology and the associated mechanization of the worldview, the machine has become a beloved metaphor: "With the emergence of the mechanical philosophies of the seventeenth century, and the ambition to give an account of the whole of nature in terms of inert matter interactions alone, it was only natural to think of life as nothing more than a specific type of machine, the difference between organisms and mere artificial automata reduced to a quantitative one, residing solely in the degree of complication. One should thus place the effort of developing a mechanical paradigm in the context of the historical emergence of modern science, with the successful appearance, especially after Galileo, of a new physics, opposed to classical Aristotelian physics and in an ongoing struggle with the animistic worldview." (Marques and Brito 2014, 78).

A century after Descartes described the workings of the human body in purely mechanistic terms, although he made—perhaps for fear of being persecuted for heresy—an exception for our immortal, immaterial soul, Julien Offray de La Mettrie in his radical *Machine Man* (1748) also explained the human mind as a sheer product of material processes (La Mettrie 1996). According to La Mettrie, we are, like other animals, merely machines, at most more complex. Or, as Daniel Dennet, a modern follower of La Mettrie, puts it—quoting a favorite pop philosopher Dilbert—"moist robots" (Schuessler 2013).

The machine metaphor has turned out to be a particularly fruitful one. Metaphors are more than "ornamental varnish" as may be seen in the case of modern medicine. When they become conventional and widely understood, they fit our accounts of truth in the same way as nonmetaphorical sentences do (Lakoff and Johnson 1980, 172). Metaphors are important cognitive tools that not only help us capture unknown or elusive things in familiar concepts but also orient our actions. Understanding the heart as a mechanical pump not only introduced a new understanding of the circulatory system but also *nudged*[1] the users of the conceptual metaphor MAN IS A MACHINE to act accordingly (Peterson 2009).[2] Conceptually, the metaphor opened the way to repair or replace broken parts, such as a defective heart valve, just as we do with machines. It took a few centuries to achieve, but since 2021 doctors can even replace a defective heart with a completely artificial heart, in this case one developed by the French company Carmat (Bailey 2021). Thus, the conceptual metaphor became what we might call a *material metaphor* (Hayles 2002, 22). An idea that has become reality. Man is not a machine, but is *literally* made into a machine on the leash of metaphor.[3]

[1] I am using the concept 'nudge' here in the definition given by Richard Thaler and Cass Sunstein in their popular book *Nudge: Improving Decisions About Health, Wealth, and Happiness*: "A nudge, as we will use the term, is any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates." (Thaler and Sunstein 2008, 6).

[2] In this chapter, following the notation used by Lakoff and Johnson, *conceptual* metaphors will be written in small capitals in order to distinguish them from the *linguistic* metaphors that have their ground in them.

[3] Although conceptual metaphors may be regarded as nudges in the sense that they are more or less "cheap to avoid", material metaphors like artificial hearts become, as soon as they have been implanted, "hard-wired mandates" in the sense that their impact on the receiver cannot be avoided. As we will see in the remainder of this chapter, this does also apply to other material metaphors like predictive algorithms, especially when they are implemented in law-enforcing decision systems. However, in as far as such material metaphor subsequently may affect, but not necessarily determine our self-understanding, they may act as conceptual nudges as well.

Well, to a degree. No matter how fruitful the machine metaphor has turned out to be, we must not confuse it with reality.[4] At best, metaphors reveal a certain aspect of what and who we are and puts that aspect in the foreground, obscuring other aspects. Although mechanistic-material metaphors dominate the current life sciences (as expressions like "sensomotoric apparatus", "molecular machines", "hard-wired pathways" illustrate), they still fail to get a grip on organic functions like agency and self-organization (Soto and Sonnenschein 2020), let alone on our inner world of subjective, (self-)conscious and intentional experiences, such as bodily sensations, thoughts, perceptions, motives, feelings, and the guidance of our lives by our moral, aesthetic and religious values (Zahavy 2005; De Mul 2019). The living experience of the color, smell and taste of strawberries, the feeling of being in love, or the beauty of Bach's cello suites cannot be described in mechanical terms. Even if you could capture these first-person, transparent and (self-)conscious experiences in a quantitative, mathematical formula, it would not equal having that qualitative experience of intentional objects itself. As Nietzsche expresses it in *The Gay Science*: "An essentially mechanistic world would be an essentially

[4] According to Nietzsche, the truths of concepts actually "are illusions of which we have forgotten that they are illusions—they are metaphors that have become worn out and have been drained of sensuous force, coins which have lost their embossing and are now considered as metal and no longer as coins." Whereas metaphors spring from living imagination, concepts display "the rigid regularity of a Roman columbarium" (Nietzsche 1980, 881–2, translation JdM, cf. the chapter "Frozen metaphors" in De Mul 1999, 35–73). In a similar spirit, Paul Ricoeur distinguishes between 'living metaphors', metaphors of which we know that they are metaphors—an imaginative, meaning creating 'seeing x as y'—from 'dead metaphors', metaphors of which we are no longer aware that they are metaphors (Ricoeur 2010, 142, 305).We find similar thoughts in post-positivistic philosophy of science, in which it is stated that the analogies on which metaphors are based make it possible to map new, not yet well understood phenomena (Hesse 1966; Keller 2002). For example, the wave theory of light found its inspiration in the wave character of physical media such as water. As a result, there are also shifts in the meaning of the terms used. For example, the application to light did not leave the meaning of the term 'wave' untouched. Metaphors mobilize concepts and ontologies. In doing so, they not only reveal similarities, but also open our eyes to the differences between the things that are brought together in the metaphor. For example, for properties of light waves that we do not find in the waves in the sea. Some philosophers of science go a step further and argue that actually all scientific models should be understood as metaphors. Even models expressed in seemingly literary terms or in mathematical formulas are not based on a one-to-one correspondence between elements of the model and of reality. They are more or less fictitious abstractions, the value of which is measured not so much by a literal correspondence, but rather—pragmatically—by the extent to which they enable us to explain, predict and control events (Van Fraassen 1980).

meaningless world! Suppose one judged the value of a piece of music according to how much of it could be counted, calculated, and expressed in formulas—how absurd such a 'scientific' evaluation of music would be! What would one have comprehended, understood, recognized? Nothing, really nothing of what is 'music' in it!" (Nietzsche 2002, 239). After all, "I do not see color-sensations but colored things, I do not hear tone-sensations, but the singer's song." (Husserl 1970, Vol. 2, 99). But while everyone is familiar with such qualitative experiences (also known as *qualia*), the volatility of our inner world makes them even more difficult to capture than our bodily characteristics, which are part of the physical, measurable outside world.

That is why, when it comes to our inner world, we have to resort to *non-mechanistic* metaphors. Because the Christian "immortal soul", to which Descartes still sought refuge has lost credibility, *stories* have become a popular identification model. After all, telling and listening to stories are important characteristics of human life (Gottschall 2012). When we try to understand ourselves and others, we often resort to stories. Moreover, our lives share essential characteristics with stories. Like a story, our life takes place in time, has a beginning and an end, is intertwined with memories of past events and anticipations of future events, and imbued with motives, goals, reasons, feelings and values (Ricoeur 1991). Like stories, our lives are characterized by the opposition of freedom and destiny, by chance and opposition. Our life is an intentional project, ceaselessly interrupted by unexpected events.[5] And unlike the material processes in the outside world, which are determined by general laws, each life story is unique. Sure, there are familiar "life genres"—quests, adventures, tragedies, romantic comedies, farces—but what makes real and fictional life stories so intriguing is precisely their uniqueness and singularity.

Because of this entanglement of stories and human life the conceptual metaphor LIFE IS A STORY has become a common metaphor (Lakoff and Johnson 1980, 172–175). And as with the machine metaphor, the story metaphor is also a conceptual and material metaphor in one. The story, argues philosopher Paul Ricoeur, not only offers a striking picture of our lives, but we actually construct our "narrative identity" through stories (Ricoeur 1992, Holstein and Gubrium 2000). From the many and often ambiguous life experiences we construct an explicit life story and then

[5] "A story is a choice that is interrupted by something accidental, something fatefully accidental; this is why stories cannot be planned, but must be told" (Marquard 1991, 120).

identify with it.[6] Other people play an important role in narrative identity. We identify ourselves with the life stories of real and fictional role models, while others play various roles in our life story (as for instance parents, children, lovers, neighbors, colleagues, officials, opponents, strangers, enemies) as well. Moreover, other people also form the audience to whom we tell our life stories. And last but not least, we play various roles in the life stories of others.

The machine metaphor and story metaphor can coexist peacefully, for example when we use them in different contexts. When we break a leg and consult a surgeon, we will probably prefer the machine metaphor, whereas the story metaphor is more convenient when we talk about a love affair with our friends. But there are also situations where different conceptual and material metaphors can be in opposition or even clash. For example, this happens when a psychiatrist, consulted by a person with depression, has to choose between a conversation about the reasons for the depression and one about the right medical treatment for its supposed genetic-material cause. Or when a jury or judge has to choose between holding accused persons fully responsible for their actions or to decide against this because such persons were forced to execute these actions or has an unsound mind (*non compos mentis*). In some cases conflicting metaphorical conceptualizations may be mixed: for example in the medical context by a combination of therapeutic talks and pills, or in the juridical context by declaring suspects partially unaccountable for their behavior.

Information Processing Systems

Humans are inexhaustible beings. The history of technology ceaselessly offers new metaphors with which we interpret our existence and disclose and create new dimensions of being human. Where the millennia-old 'alpha technology' of the spoken, performed and written story gave us a narrative identity and the more recent 'beta technology' of the machine a mechanistic self-image, with the development of the computer and the information technologies based on it, a new source of self-identification

[6] Because of this identification our 'narrative identity' is not, as Dennett wrongly states in 'The self as a center of narrative gravity', the same kind of theoretical fiction as the 'center of gravity' in physics (Dennett 1992). Although both 'narrative identity' and 'center of gravity' are theoretical fictions, unlike the 'center of gravity' that we attribute to a physical object, 'narrative identity' is a 'fiction' that we *are* and actively *live*. We might call it a fictitious entity, but as a material metaphor, it is a fiction that causes real effects.

has come to the fore.[7] With the computer metaphor, the human being—and in particular the human brain—is represented as an 'information-processing machines' (HUMANS ARE COMPUTERS[8]) or the processed products of computational systems (HUMANS ARE COMPUTATIONS[9]).

The fascinating thing about the computer is that it bridges the gap between the alpha and beta technologies mentioned. Although computers are machines, or more precisely: the subclass of automatons, machines which can independently process data with the help of a hard-wired or software program, the processed data also include stories (for example in narrative computer games) and other linguistic and language-based phenomena, such as law (legal expert systems) and politics (voting aids). And in social interaction, the computer also functions as a 'gamma technology', regulating human actions. Social networks such as Facebook and TikTok, dating sites such as Tinder and Parship and GSM, BLE, GPS and NFC chips in mobile phones and smart cards nudge our actions or even determine with whom and in what way we can communicate or meet other persons, which spaces or means of transport we are allowed to enter and what financial transactions we can carry out, as but a few examples.

Because the programmable computer "could in fact be made to work as a model of any other machine," Turing called it "a universal machine" (Turing 2004, 383). Information technology is therefore also referred to as a "system technology," not only because it consists of a complex multitude of heterogeneous components (e.g., hardware, software, protocols,

[7] The terms alpha, beta and gamma technologies used in this section refer to technologies that relate respectively to knowledge and cultural transfer (such as writing, printing, film, radio, TV), to the interaction with nature (hand axe, steam engine, nuclear plant, microscope, telescope, etc.) and social interaction (means of transport and communication such as cart, ship, train, plane, letter, telephony, e-mail). Using the first three letters of the Greek alphabet to distinguish these three types of technology is inspired by the custom to refer to the three classes of sciences (humanities, natural sciences and social sciences) as alpha-, beta- and gamma-sciences.

[8] It is not without irony that in this conceptual metaphor computers are used as source domain and human beings as target domain, as originally the human being was used as the source domain and the machine as the target domain. When, in 1936, Turing wrote 'On computable numbers', in which he famously introduced the idea of a programmable 'computer' (nowadays known as 'the Turing computer'), a computer was not a machine at all, but a human being, working as a mathematical assistant (Turing 2004, 40, 58–90).

[9] This conceptual metaphor is part of a family of conceptual metaphors, ranging from REALITY IS A MASSIVELY PARALLEL COMPUTING MACHINE (Steinhart 1998) and LIFE IS A COMPUTER SIMULATION (Bostrom 2003) to MIND IS PROCESSED BY THE BRAIN (Barrett 2021).

legislation, designers, users), but also because it is intertwined with almost all other systems and processes in society. That is why information technology increasingly functions as the 'operating system' of our social and personal lives. In this sense, the computer metaphor is, just like the machine and story metaphors, both a conceptual and a material metaphor, but because of its universal applicability, affecting virtually all aspects of human life, its impact is especially pervasive.

The thesis I want to defend in the remainder of this chapter is that this metaphor not only nudges us to think of ourselves as a database, but also literally transforms us into databases, often in compelling and unavoidable ways.

Databases

Digital and digitalized data—such as numbers, words, images, and sounds—are the raw material for computers. Basically, computers receive, store, process and output data. For that reason, data management constitutes the basis of information technology and databases play a crucial role in virtually all computer programs. However, the term 'database' can refer to different things. In the first place, it is used to indicate a *collection of data*, but it can also refer to the *physical carrier* of that data (book, card box, computer memory) or to the way data are organized (the *database model*). After all, digital database management systems are not only used to store data, but also to maintain and query them (Lemahieu et al. 2018).

With regard to the database, four basic operations can be distinguished, which are sometimes called the ABCD of persistent storage: *Add*, *Browse, Change* and *Delete*.[10] Databases have a long history, which is characterized by increasing flexibility. The old-fashioned telephone *book* is an example of a rigid paper database. Although it was quick and efficient to look up (browse) a subscriber's name, adding, changing, or deleting data required phone books to be reprinted entirely, much to the chagrin of the postmen who had to distribute them.

Card index boxes with contact details had the advantage that data more easily can be added, changed and deleted. However, the problem remained

[10] These four operations equal four basic commands in the Structured Query Language (SQL), which is used to design and operate relational databases. Synonyms of ABCD are ACID (Add, Create, Inquire, and Delete) and CRUD (Create, Read, Update and Delete). See for a short explanation of these SQL commands (Sulemani 2021).

that this type of database, like the phone book, could only be searched along one specific attribute, for example the name of the subscribers. If you want to systematically browse through another attribute, you have to rearrange the card index box in its entirety or use multiple card boxes next to each other, such as in the old-fashioned library, in which the same data are arranged twice, in two different card index boxes: once by author and once by subject. And copying and distributing card boxes remained a time-consuming activity, too.

With the computers connected in networks, the flexibilization of data management has taken off. Already with a simple spreadsheet program, a contact list can be organized by any attribute (name, address, zip code, telephone number, e-mail address, age, partner, profession, etc.) by a single mouse click. Copying and exchanging data or even complete databases is also quite easy.

The first digital database management systems were introduced in the 1950s and in the course of their history different database models have been developed, such as hierarchical and network databases. The *relational database*, developed in the 1960s and 1970s, is in a way the highlight of this flexibilization process. In this type of database, which is based on set theory and predicate logic, the object of data management is 'atomized', divided as much as possible into single, non-divisible elements (Codd 1970). With the help of queries, the user can combine virtually every possible combination of those elements, in order to prioritize, classify, associate and filter them.

This increase in flexibility is connected to the fact that in relational databases, queries are not pre-defined. Customers, querying the database behind the websites of the web shop, database streaming service or dating site, can easily select the article, film or partner that meets all their criteria. And if a mobile phone company has stored all the customer's data in a relational database, it could, for example, easily select all customers whose telephone subscription expires in two months in order to make them an appropriate renewal offer, based—for example—on the previous subscription type, previously purchased telephone and/or payment history.

Database management systems are potentially economic goldmines. Although there are also non-profit database projects like Wikipedia, the boom of the internet has strongly been stimulated by commercial enterprises. The financial successes of multinational Big Tech companies, such as the internet and e-commerce giants Google and Amazon, social networks like Facebook, Instagram, TikTok and Twitter, streaming services like Spotify and Netflix and dating sites like Tinder and Parship are based on the transformation of both the customer base and the products on offer into large relational databases. When you order a book from Amazon, your personal data is not only related to your search and purchase history and your reviews, but also to those of all other customers. Based on these correlations Amazon makes you recommendations of the type "Customers who bought x also bought y." Meanwhile, more than 35% of all items sold by Amazon are the result of such recommendations, and no less than 75% of what we stream on Netflix (Clark 2018).[11]

Databasification of Human Life

However, the impact of the 'databasification' of human beings is not limited to the economic sphere. Thanks to the 'datafication of everything', more and more data are linked to our personal data, from our financial transactions, debts, energy use, telephone traffic, website visits and movements through geographical space to our medical and genetic data, ethnic characteristics and sexual and political preferences. In addition, numerous, more or less heterogenous and structured databases are increasingly being merged into gigantic 'data warehouses' and even bigger 'data lakes' (Big Data), which are subjected to various forms of data linking, data mining and data analysis. With the help of profiling techniques, patterns and correlations in the characteristics and behavior of groups and individuals are uncovered for the purpose of diagnosing, predicting and controlling social interactions (Lemahieu et al. 2018, 549–730).

Various forms of artificial intelligence (AI) are also used. The two main types are classical rule-guided algorithms and self-learning neural networks (Fry 2018). In the first type, the instructions of these algorithms are drawn up by a human and are direct and unambiguous. As with a recipe, the instructions are step-by-step. An example of this type is the decision trees used to predict flight or public safety risk in case of making pretrial release decisions. In the case of neural networks (nowadays branded as *self-learning* or *deep learning*) the program independently and in an—even for experts—unpredictable and unexplainable way, discovers patterns in large data collections. Doctors, for example, use neural networks to distinguish

[11] In 2012, Amazon acquired a patent for an "anticipatory shipment" algorithm, which sends items in your direction even before you've ordered them or even knew you'd like to do so this in the near future (Lomas 2014).

benign from malignant tumors and bioinformaticians use databases with clinical and genetic data from patients to find out which genetic abnormalities correspond to certain disease patterns, on the basis of which molecular geneticists can develop a therapy (for example, by using CRISPR/Cas9—a programmable genetic scissor—to replace pathogenic genes with healthy ones) or to predict what chance a still healthy person has of developing a specific disease in the future, so that the patient is nudged to adjust his lifestyle if needed. Neural networks often perform better in diagnosing and predicting diseases than medical experts.[12]

Moreover, with the help of a genetic database, it is possible to recombine genes of humans and other organisms (De Mul 2021). For example, human genes are 'built into' the genome of sheep to produce medicines for hemophilia and cystic fibrosis. And in January 2022, a patient in Baltimore, with severe heart disease, was implanted with a pig's heart after it underwent genetic modification so that it will—hopefully—not be rejected by the patient's immune system (Reardon 2022). Such human-animal combinations are organic metaphors of database technology.

The development of the electronic computer in the 1940s was strongly stimulated by the Second World War, especially by demands in the domains of ballistics and encryption and decoding. Many contemporary diagnostic, predictive, and control-oriented forms of Big Data analysis continue these kinds of computing. Governments, for example, use these types of data analytics to detect potential fraudsters, criminals and terrorists, or—often in close collaboration with scientists of different stripes—to predict socio-economic, financial, political, military, epidemiological and climatic trends and developments.

The aforementioned examples indicate that database technologies and data analytics may have a disruptive societal impact. In the domain of

[12] In 2019, a large systematic review and meta-analysis of 14 studies, in which the performance of deep learning networks was compared with that of health-care professionals, and which provided enough data to construct contingency tables, enabling the calculation of the sensitivity (do the networks and professionals see what they need to see?) and specificity (don't the networks and professionals see things that aren't there?), the researchers found that the present deep-learning networks already perform slightly better than the professionals: "Comparison of the performance between health-care professionals in these 14 studies, when restricting the analysis to the contingency table for each study reporting the highest accuracy, found a pooled sensitivity of 87·0% (95% CI 83·0–90·2) for deep learning models and 86·4% (79·9–91·0) for health-care professionals, and a pooled specificity of 92·5% (95% CI 85·1–96·4) for deep learning models and 90·5% (80·6–95·7) for health-care professionals." (Liu et al. 2019).

economy and finance it disclosed the era of "surveillance capitalism" (Zuboff 2018, Sadowski 2020), in science and technology it leads to new digital epistemologies and paradigm shifts (Kitchin 2014), and in governance it inspired new ideas and practices of biopolitics (Johns 2021).

Weapons of Math Destruction

Although it is undeniable that the datafication of human life has countless useful applications, in recent decades the dark sides have also become visible. In 2008, non-transparent financial algorithms were at the root of a global banking crisis (Reyes 2019), and two years later, algorithms that help stockbrokers automatically sell when prices fall led to a Flash Crash (Poirier 2012). The business model of Big Tech companies such as Facebook and Google, which aim at the generation of as much marketable data and traffic as possible, has not only lead to giga profits for these companies, but also to fake news, anti-social behavior and social tensions. They not only predict our behavior but also influence and modify it, often with disastrous consequences for democracy and freedom (Zuboff 2018).

The damage was not limited to the financial and economic world. Whistleblowers such as Edward Snowden revealed that civilian and military intelligence and security services in the US illegally and widely tapped data and in 2018 the equally illegal manipulation of Facebook users' data by Cambridge Analytica, benefitting the Trump campaign, led to great outrage (Hu 2020). Nor was the damage limited to the US. In China databases and data analysis are being used en masse to develop new forms of digital disciplining and biopolitics, as the social credit system and the Uyghurs' ethnocide in Xinjiang province show (Roberts 2018). And Russian trolls, often working in close cooperation with the government, are actively undermining Western democracies by spreading fake news via social media.

With regard to pitfalls associated with database technology, different causes can be distinguished. In the first place, they can be the result of faulty data. A well-known adage in data management is 'garbage in, garbage out' (Mayer-Schönberger and Cukier 2013). For example, medical expert systems often only use the data of white male patients, so there is a good chance that women or non-white people will be misdiagnosed or prescribed the wrong therapy (Feldman et al. 2019; Ledford 2019).

Although the Latin word 'data' literally translated means 'given', in reality data are never simply given, but are created and selected. Even seemingly objective personal data such as date of birth, gender and nationality are not natural facts, but are assigned to people on the basis of certain cultural conventions and historical developments. For example, a date of birth depends on the use of a Gregorian or Islamic calendar. And the current gender discussions show that 'gender' is not a simple fact, but a choice that is not without prejudice (*bias*). Whether one can choose from two genders or—as with Facebook since 2014 (Goldman 2014)—from 58 different genders (which for Facebook means profit from both the point of view of atomization and marketing) depends on the choices offered to the user. And whether categorizations such as country of origin, ethnicity, religion, political preference or criminal record are part of governmental databases is the result of political decisions.

Secondly, much depends on the quality and the correct interpretation of the outcome of the algorithms used. Data mining is all about discriminating, that is: making distinctions. Does the image concern a good or malignant tumor, is this person a fraudster or not, does this music fall within the taste pattern of the consumer or outside it? The middle ground must be found between 'sensitivity' (does the algorithm see everything that it needs to see?) and 'specificity' (does it leave out what does not belong to the category?). That is a precarious balance where mistakes can easily arise (Fry 2018). Moreover, not only do people have biases, but algorithms also develop them. We see this, for example, with AIs such as PredPol, a *predictive policing* program aimed at predicting and preventing criminal behavior by means of where-who-when registration of certain forms of crime in the city (Karppi 2018). If, on the basis of such a prediction, more surveillance is carried out in a certain neighborhood and more criminals are caught as a result, this has a self-reinforcing effect (it becomes a self-fulfilling prophecy), because more crime data are collected in those neighborhoods, which in turn leads to a greater deployment of police.

The profiling of possible perpetrators has the same effect, because if more people from a certain ethnic group are arrested, that group will also be more strongly represented in the crime data. This happened, for example, with the artificially intelligent System Risk Indication (SyRI), which was used in The Netherlands by the Tax and Customs Administration to predict allowance fraud and which used 'dual nationality' as one of the selection criteria between 2012 and 2015 (Van Bekkum and Zuiderveen Borgesius 2021). This also led to ethnic profiling. In these cases, discrimination not only leads to distinction, but also to unequal treatment of citizens, which is contrary to the first article of the Dutch constitution.

Algorithms, argues mathematician Cathy O'Neil in *Weapons of Math Destruction*, not only inadvertently cause harm, suffering and injustice, but they are often deliberately abused by Big Tech companies, bankers, stockbrokers and governments to enrich themselves at the expense of others or to undermine the rule of law and democracy (O'Neil 2016).

Dehumanization by Malgorithm

The philosopher Martin Heidegger argued in the 1950s—the formative years of the electronic computer—that human beings think they rule the earth with the help of modern technology, but they are doomed to become the "most important raw material" (*wichtigsten Rohstoff*) of technological control themselves (Heidegger 1973, 104).

The danger Heidegger is pointing at goes beyond the aforementioned damage caused by 'malgorithms'. On a more fundamental level, what it is to be human, humanity itself, is at stake. The datafication of humans reduces human beings to a quantifiable and calculable 'thing'. This dehumanizing reduction is a common feature of the computer metaphor and the machine metaphor, but the computer metaphor goes a crucial step further by making not only the human body an object of calculation, but our qualitative experiences—beauty, justice, love—as well. The ideology of 'Dataism' (De Mul 2009), the belief that everything can be captured in quantifiable data, that these data are objective and that algorithms and artificial intelligences are infallible, leads to the deprivation of feelings and qualitative judgments, because within this ideology they are considered to be 'subjective', 'irrelevant', 'misleading' or even 'illusory'.

Especially predictive algorithms undermine our experience of freedom and responsibility. Morality and law are based on the idea that we have a certain freedom of action. Under normal human conditions, we are held accountable for our behavior because we could have acted differently than we de facto did. And we are judged on what we have done in the past. These ideas are closely linked to the story metaphor. Like all metaphors, this metaphor is a product of imagination and as such fictitious. But as a material metaphor, it functions as what Kant in his *Critique of Judgement* calls a "heuristic fiction", an imaginative fiction with real effects, that actually makes us free and responsible (Kant 2007, A771).

Predictive algorithms, on the other hand, claim to be able to determine what our future behavior and future circumstances will be. They peg us in the present down as the consumer, patient, criminal or dissident that we will be in the future. In doing so, they undermine our narrative causality, our ability to steer our actions by reasons. But it is thanks to this very ability that we can be held accountable for our actions and their future consequences. A judge will therefore attach great importance in his judgment to the reasons that a suspect had for his actions. Big Data analysis, on the other hand, completely ignores narrative causality. Or as Mayer-Schönberger and Cukier put it, not without pride (sic): "Knowing *what*, not *why*, is good enough" (Mayer-Schönberger and Cukier 2013, 52).

That statement is correct in the sense that Big Data analysis indeed is not focused on causal relationships, but only deals with more or less accidental statistical correlations. The fact that there is a remarkable correlation between eating ice creams and wildfires does not mean that eating ice cream causes forest fires, or that you could fight wildfires by banning ice creams. The situation is even worse if the correlation, which is erroneously understood as a causal relationship, is the result of discriminatory choices, such as in the 'childcare benefits scandal', which forced the Dutch government in 2021 to resign. One of the causes of the discrimination was that having a dual nationality was used as a risk factor for fraud, which lead to the belief of tax authorities that having dual nationality is the cause of fraud and that you could combat fraud by punishing persons with dual nationality in advance, reversing the burden of proof (N.N. 2021). It is reminiscent of the visionary science fiction movie *Minority Report*, in which predicted crime leads to 'anticipatory imprisonment' of the suspects (Spielberg 2002).

Spielberg's film revolves around the question of whether free will exists if the future can be predicted. The danger of predictive algorithms is not so much that they show that freedom to determine your own future does not exist, but that they destroy this freedom in a double sense. On the level of the conceptual metaphor—COMPUTERS CAN PREDICT THE FUTURE—they nudge us to—consciously or unconsciously—believe that the predictions are objective truths and that, for that reason, there is no alternative to the predicted outcome. But as this metaphor also acts as a material metaphor, it also has real consequences: the victims were not only excluded from childcare benefits, but also fined and put in a downward poverty spiral. They were rendered guilty by the prediction. Although the punished were not, like the accused in *Minority Report*, locked up and killed, they became just like them as 'prisoners of prediction' and robbed of their future.

Behind predictive algorithms is a malignant paradox. Predictive algorithms pretend to predict the future, but in fact they rely entirely on extrapolations of the past. That may be useful when it comes to events in inanimate nature, obeying fixed natural laws, but it ignores the openness to the future that characterizes narrative causality. Human beings are unfathomable and inexhaustible. As a result, the actions of individuals are never completely predictable. An inveterate atheist can convert on her deathbed, a criminal can repent, and a faithful partner can turn out to be a cheater. Historical events—wars, epidemics, scientific inventions—are also fundamentally unpredictable. Or, as Wilhelm Dilthey, one of the founders of the theory of narrative identity puts it: “We will never be done with what we call chance [*Zufall*]; what has become significant for our life, whether wonderful or fearsome, seems always to enter through the door of chance” (Dilthey 2002, 96).

When humans are pulled through the digital shredder of the database, they lose their indivisible individuality and literally become dividuals, collections of digital data fragments in a data lake. That may be useful for Big Tech companies and governments in their quest for algorithmic profit, disciplining and biopolitics, but it also destroys those characteristics that give the human being its humanity: the experience of agency and responsibility.

Nudging Metaphors

It would be naïve to think that datafication, algorithms and artificial intelligence will disappear. And because they can be useful tools in our efforts to cope with the increasingly complex problems we face in the twenty-first century, such as the climate crisis, that option would not be desirable either. But it is of the utmost importance to prevent the disadvantages and dangers associated with these means—the widening of the gap between rich and poor, the undermining of the rule of law and democracy, and the destruction of human freedom and responsibility—from overtaking their usefulness and itself becoming the greatest threat for human life.

Fortunately, there is growing attention for the harmful consequences of using automated databases and attempts are being made to design databases that respect economic justice, the rule of law and human dignity. Fundamental themes are at stake, such as a fair right of ownership and use of the data produced by the users, transparency and explainability of the algorithms and AIs used and democratic control of national and international database management in all social domains, and—last but not least—our very humanity.

The challenges are huge. The opponents—Big Tech and authoritarian states such as China and Russia—are powerful and can only be contained by the cooperation of all forces that represent the aforementioned values, both in civil society and at (inter)national political levels. It is encouraging that awareness of the dangers of information technology and social media is growing and that initiatives are emerging both nationally and internationally to achieve better regulation. In April 2021, the European Commission presented an Artificial Intelligence Act. "The Act seeks to codify the high standards of the EU trustworthy AI paradigm, which requires AI to be legally, ethically and technically robust, while respecting democratic values, human rights and the rule of law" (European Commission 2021a, b). According to this Act, AI systems must comply with these acts in order to be admitted to the European market and in November 2021, EU countries joined the Digital Services Act (DSA) and Digital Markets Act (DMA) that are intended to protect users from harmful content and must prevent the Big Tech companies from abusing their power.

In order to develop laws and regulation that can help us to prevent algorithms and artificial intelligences from causing harm, it is important to remain alert to the ontological and deontological implications of the conceptual and material metaphors that underlie database management systems. And to remain able to detect potentially harmful effects, to nudge them in the right direction or to replace them by alternatives that help to make human life flourish instead of shrivel.

This requires a 'material metaphor criticism', which is situated somewhere in between literary criticism, philosophy of technology, and political theory. Such a 'politico-poetic' project cannot escape being nudged by material metaphors (such as technologies), but at the same time it should on its turn be able to nudge these metaphors. It should not only make us aware of the aforementioned dangers, but it should also be imaginative, because without our metaphor-creating imagination, we will not be able to nudge existing metaphors and create new ones when necessary. Humans should always remain in a narrative feedback loop in order to be able to nudge the metaphors that nudge us. In order to nourish the vital imaginative powers that are needed for this task, we must open ourselves to the creative and inexhaustible recombinatoriality that characterizes human life.[13]

This article began with the observation that humans are unfathomable. One of the implications of this is that human actions, in the final analysis, are unexplainable. It is true that within the narrative view of human life, we assume that people have reasons for what they say and do, but there is an end to the justification. Sooner or later we come across the fluid foundations of justification.[14] When we consider that the computer is a metaphorical transfer from human calculation to a machine, we should reverse the aforementioned computer metaphor HUMANS ARE COMPUTERS into COMPUTERS ARE HUMAN.[15] In the case of neural computer networks, this is reflected, among other things, in the fact that, in the final analysis, they are

[13] These imaginative powers have their roots in the recombinational character of human thought and language. Human language distinguishes itself by semantic compositionality. The meaning is determined not only by the meaning (semantics) of the constituent parts and the context in which they are used (pragmatics), but also by the way in which they are combined (syntax), from 'flying horses' in Greek mythology to 'thinking machines' in the epoch of modern technology. Human imagination is not alone in this; this recombinatory database ontology is a phenomenon that characterizes the entire physical, organic and psychic nature (matter, life and consciousness). Just as physics and chemistry investigate the recombination of elementary particles and elements, and the life sciences study the recombination of the genetic elements, so do the humanities study the cultural recombination of human thoughts, artifacts, and actions.

[14] Compare Wittgenstein reflections on the final uncertainty of our believes:94. But I did not get my picture of the world by satisfying myself of its correctness; nor do I have it because I am satisfied of its correctness. No: it is the inherited background against which I distinguish between true and false.95. The propositions describing this world-picture might be part of a kind of mythology. And their role is like that of rules of a game; and the game can be learned purely practically, without learning any explicit rules.96. It might be imagined that some propositions, of the form of empirical propositions, were hardened and functioned as channels for such empirical propositions as were not hardened but fluid; and that this relation altered with time, in that fluid propositions hardened, and hard ones became fluid.97. The mythology may change back into a state of flux, river-bed of thoughts may shift. But I distinguish between movement of the waters on the river-bed and the shift of the bed itself; though there is not a sharp division of the one from other. (Wittgenstein 1969, 15e)

[15] See note 8 on the origin of Turing's name to his universal machine. In the present context, this reversal means that we must understand and treat artificial intelligence as an extension of human intelligence and not as an external form of intelligence. In terms of the theory of technological mediation, our relationship to artificial intelligences should be shaped as an embodiment relation rather than an alterity relation (Ihde 1990, respectively72 ff. and 97 ff.).

not transparent and unexplainable, just like the neural networks in the human brain (ALL NEURAL NETWORKS ARE UNEXPLAINABLE).

While we have to accept the unexplainability of people as a fact of life, we understandably have a lot of trouble with accepting it in digital computers. That is also one of the main underlying reasons for the European demand that algorithms and artificial intelligences must be transparent and explainable. Where this is possible with traditional, rule-based AI, this is not the case with neural computer networks. True, an important part of the current AI research aims at increasing transparence and explainability of neural computer networks by developing rule-based software that can make neural networks locally explainable.[16] However, total explainability is as impossible for artificial neural networks as it is for the neural networks in our brains. The complexity of both go beyond human intelligence. The number of neurons in the neural network of a single human being is about 86 billion, almost as much as the number of stars in our galaxy! The recombinational complexity of artificial neural networks, how impressive it already may be, is still almost negligible compared to the complexity of the human brain. As artificial networks become even more complex, their explainability will just grow.

The unexplainability of artificial neural networks is an additional reason for keeping humans 'in the loop' (ARTIFICIAL NEURAL NETWORKS NEED HUMANS). In the case of database management systems humans must be active on both sides of the technological mediation: the representatives of the company or the governmental body designing and using the database management system as a commercial or bio-governmental instrument, as well as the consumers and citizens whose data are being used in the process of data profiling, mining, analytics etc. in order to nudge and enforce their actions.

The designers and users should be in the loop because someone must be responsible and accountable for the use of the database management system. Although human actions may be as unexplainable as the processes of the neural network, unlike the system, the human operator can be held responsible and accountable ('I don't know why I did it' doesn't make a human person less responsible and accountable, and neither should he

[16] In visual networks, a certain degree of explainability can be achieved by investigating to what extent which parts of the visual image determine the outcome. For example, neural networks used to select certain bird species from a multitude of images of different birds appear to assign a relatively heavy weight to the head. (Ras et al. 2018).

resort to 'computer says no' kind of arguments). In a way, this is part of the tragic condition of human life: in the final analysis, we are responsible and accountable for the unforeseen and unforeseeable consequences of our actions.

In the case of the person who is the 'subject' (and therefore in danger of becoming the "most important raw material") of the database management system, there should always be a degree of freedom with regard to decisions of the system. In this case two different types of 'material metaphors' have to be distinguished: nudging versus enforcing types of technology. An example of a nudging-type is the so-called 'persuasive mirror' that will display what you will look like in five years' time if you get no exercise, and live on booze and junk food. (Knight 2005a).[17] It nudges the person in the direction of a healthier lifestyle, but the mirrored person remains free to follow the nudge and as such also remains responsible for the outcome.

In the case of the Dutch childcare benefits scandal, the material metaphor was not nudging, but acting as an external, (law-)enforcing entity. There was no room to escape the decisions of the system, and complaints about wrongful decisions were not heard by the tax authorities. Even when such systems would work perfectly, they are dehumanizing because they take away our fundamental freedom and responsibility (Mulligan 2008). Although less scandalous at first sight, the hidden algorithms behind the search engines and social networks are no less dehumanizing. With these types of behavior-enforcing database management systems, there should always be a possibility and procedure to resist the decision, and to force the representative of the system to explain the decision or to withdraw it.

In cases of erroneous systems, this may cause a lot of regulation and bureaucracy. However, this is a small price for saving the humanity of human beings.

[17] "A computer builds up a profile of your lifestyle, using webcams dotted around your house. The images of your activities are sent to a software able to identify, for instance, when you have spent most of the day sitting on the couch, and will spot visits to the fridge. Once the profile is built up, another software will extrapolate how this behavior could affect your weight in the long term: eat too much and the computer will add pounds to your reflection in the mirror. Another package will work on your face. If you are a heavy drinker, your reflection will show early wrinkles, shadows under the eyes and blotchy skin" (Knight 2005b).

References

Bailey, Stephanie. 2021. "This new artificial heart responds to the patient." [CNN Business], accessed February 3. https://edition.cnn.com/2021/03/25/business/carmat-artificial-heart-spc-intl/index.html.

Barrett, Lisa Feldman. 2021. "This is how your brain makes your mind." https://www.technologyreview.com/2021/08/25/1031432/what-is-mind-brain-body-connection/.

Bostrom, Nick. 2003. "Are we living in a computer simulation?" *The Philosophical Quarterly* 53 (211): 243–255.

Clark, Alisson. 2018. "How helpful are product recommendations, really?", accessed February 9, 2022. https://news.ufl.edu/articles/2018/09/how-helpful-are-product-recommendations-really.html.

Codd, E.F. 1970. "A Relational Model of Data for Large Shared Data Banks." *Communications of the ACM* 13 (6): 377–387.

De Mul, Jos. 1999. *Romantic Desire in (Post)Modern Art and Philosophy*, *The SUNY series in postmodern culture*. Albany, NY: State University of New York Press.

De Mul, Jos. 2009. "Dataïsme. Het kunstwerk in het tijdperk van zijn digitale recombineerbaarheid." In *Anders zichtbaar: de visuele constructie van het humanisme* edited by Johan Swinnen, 264–176. Brussel: VUB Press.

De Mul, Jos. 2019. "The emergence of practical self-understanding. Human agency and downward causation in Plessner's philosophical anthropology." *Human Studies* 42 (1): 65–82.

De Mul, Jos. 2021. "From mythology to technology and back. Human-animal combinations in the era of digital recombinability." In *Ecology 2.0. The Contribution of Philosophical Anthropology to Mapping the Ecological Crisis*, edited by Katharina Block and Julien Kloeg, 79–97. Berlin: De Gruyter.

Dennett, D.C. 1992. "The Self as a Center of Narrative Gravity." In *Self and Consciousness*, edited by F. Kessel, P. Cole and D. Johnson, 275–288. Hillsdale, NJ: Erlbaum.

Dilthey, Wilhelm. 2002. *The Formation of the Historical World in the Human Sciences. Selected Works. Vol. 3.* Edited by Rudolf A. Makkreel and Frithjof Rodi. Princeton, N.J.: Princeton University Press.

European Commission. 2021a. Artificial Intelligence Act.

European Commission. 2021b. "AU Artificial Intelligence Act: The European Approach to AI." https://futurium.ec.europa.eu/en/european-ai-alliance/document/eu-artificial-intelligence-act-european-approach-ai.

Feldman, Sergey, Waleed Ammar, Kyle Lo, and et al. 2019. Quantifying Sex Bias in Clinical Studies at Scale With Automated Data Extraction. *JAMA Open Network* 2 (7). https://doi.org/10.1001/jamanetworkopen.2019.6700.

Fry, Hannah. 2018. "Hello world: how to be human in the age of the machine." In. London: Transworld Digital.

Goldman, Russell. 2014. "Here's a List of 58 Gender Options for Facebook Users." ABC News, accessed February 21. https://abcnews.go.com/blogs/headlines/2014/02/heres-a-list-of-58-gender-options-for-facebook-users.

Gottschall, Jonathan. 2012. *The Storytelling Animal. How stories make us human*. Boston: Houghton Mifflin Harcourt.

Hayles, N. Katherine. 2002. *Writing Machines*. Cambridge: The MIT Press.

Heidegger, M. 1973. *The End of Philosophy*. New York: Harper & Row.

Hesse, Mary B. 1966. *Models and analogies in science*. [Notre Dame, Ind.]: University of Notre Dame Press.

Holstein, James A., and Jaber F. Gubrium. 2000. *The Self We Live By: Narrative Identity in a Postmodern World*. Oxford: Oxford University Press.

Hu, Margaret. 2020. "Cambridge Analytica's black box." *Big Data & Society* (July–December): 1–6. https://doi.org/10.1177/2053951720938091.

Husserl, Edmund. 1970. *Logical Investigations (2 Volumes)*. New York: Routlaedge & Kegan Paul.

Ihde, Don. 1990. *Technology and the Lifeworld*. Bloomington/Minneapolis: Indiana University Press.

Johns, Fleur. 2021. "Governance by Data." *Annual Review of Law and Social Science* 17: 53–71.

Kant, I. 2007. *The Critique of Judgement*. Oxford/New York: Oxford University Press.

Karppi, Tero. 2018. "'The Computer Said So': On the Ethics, Effectiveness, and Cultural Techniques of Predictive Policing." *Social Media + Society* (April-June):1–9. https://doi.org/10.1177/2056305118768296.

Keller, Evelyn Fox. 2002. *Making sense of life. Explaining biological development with models, metaphors, and machines*. Cambridge, Mass: Harvard University Press.

Kitchin, Rob. 2014. "Big Data, new epistemologies and paradigm shifts." *Big Data & Society*: 1–12.

Knight, W. 2005a. "Mirror that reflects your future self." *New Scientist*, February 5, 23.

Knight, W. 2005b. "Mirror that reflects your future self." accessed February 24, 2022. https://we-make-money-not-art.com/mirror_that_ref/.

La Mettrie, Julien Offray de. 1996. *Machine Man and Other Writings*. Translated by Ann Thomson. Cambridge: Cambridge University Press.

Lakoff, George, and Mark Johnson. 1980. *Metaphers We Live By*. Chicago/London: The University of Chicago Press.

Ledford, Heidi. 2019. "Millions of black people affected by racial bias in health-care algorithms." *Nature* 574 (October 31): 608–609.

Lemahieu, Wilfried, Seppe vanden Broucke, and Bart Baesens. 2018. *Principles of database management: the practical guide to storing, managing and analyzing big and small data*. Cambridge: Cambridge University Press.

Liu, Xiaoxuan et al. 2019. A comparison of deep learning performance against health-care professionals in detecting diseases from medical imaging: a systematic review and meta-analysis. *Lancet Digital Health* 1: e271–97. https://doi.org/10.1016/S2589-7500(19)30123-2.

Lomas, Natasha. 2014. “Amazon Patents “Anticipatory” Shipping—To Start Sending Stuff Before You’ve Bought It.” accessed 16 februari 2014. http://techcrunch.com/2014/01/18/amazon-pre-ships/.

Marquard, O. 1991. *In Defense of the Accidental: Philosophical Studies*, *Odéon*. New York: Oxford University Press.

Marques, Victor, and Carlos Brito. 2014. “The rise and fall of the machine metaphor. Organizational similarities and differences between machines and living beings.” *Verifiche* XLIII (1–3):77–111.

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

Mulligan, Christina M. 2008. “Perfect Enforcement Of Law. When To Limit And When To Use Technology.” *Richmond Journal of Law & Technology* 14 (4): 1–49.

N.N. 2021. “Dutch childcare benefits scandal.” accessed February 8. https://en.wikipedia.org/wiki/Dutch_childcare_benefits_scandal.

Nietzsche, F. 1980. *Sämtliche Werke. Kritische Studienausgabe*. Vol. Band 7: Nachgelassene Fragmente 1869–1874.

Nietzsche, F.W. 2002. *Beyond Good and Evil: Prelude to a Philosophy of the Future*. Translated by Rolf-Peter Horstmann and Judith Norman, *Cambridge Texts in the History of Philosophy*. Cambridge, U.K./New York: Cambridge University Press.

Nietzsche, F.W. 2006. *On the Genealogy of Morality*. Translated by Keith Ansell-Pearson and Carol Diethe, *Cambridge texts in the history of political thought*. New York: Cambridge University Press.

O’Neil, Cathy. 2016. *Weapons of math destruction : how big data increases inequality and threatens democracy*. First edition. ed. New York: Crown.

Peterson, Mary Jane. 2009. “Human 2.0. Conceptual Metaphors of Human Beings in Technologists’ Discourse. A Study of the MIT Media Lab’s Human 2.0 Symposium.” PhD, Human and Oganizational Systems, Fielding Graduate University.

Poirier, Ian. 2012. High-Frequency Trading and the Flash Crash: Structural Weaknesses in the Securities Markets and Proposed Regulatory Responses. *Hastings Business Law Journal* 8: https://repository.uchastings.edu/hastings_business_law_journal/vol8/iss2/5. Accessed February 22, 2022.

Ras, Gabriëlle, Marcel van Gerven, and Pim Haselager. 2018. “Explanation methods in deep learning: Users, values, concerns and challenges.” In *Explainable and Interpretable Models in Computer Vision and Machine Learning*., edited by

Hugo Jair Escalante, Sergio Escalera, Isabelle Guyon, Xavier Baró, Yağmur Güçlütürk, Umut Güçlü and Marcel van Gerven. Cham: Springer.
Reardon, Sara. 2022. "First pig-to-human heart transplant: what can scientists learn?" *Nature* 601 (February 21): 305–306.
Reyes, G. Mitchell. 2019. "Algorithms and Rhetorical Inquiry: The Case of the 2008 Financial Collapse." *Rhetoric and Public Affairs*: 569–614. https://doi.org/10.14321/rhetpublaffa.22.4.0569.
Ricoeur, P. 1991. "Narrative identity." In *On Paul Ricoeur. Narrative and Interpretation*, edited by D. Wood, 188–199. London: Routledge.
Ricoeur, Paul. 1992. *Oneself as another*. Chicago: University of Chicago Press.
Ricoeur, Paul. 2010. *The rule of metaphor. The creation of meaning in language, Routledge classics*. London: Routledge.
Roberts, Sean R. 2018. "The biopolitics of China's "war on terror" and the exclusion of the Uyghurs." *Critical Asian Studies* 50 (2): 232–258. https://doi.org/10.1080/14672715.2018.1454111.
Sadowski, Jathan. 2020. *Too Smart. How Digital Capitalism Is Extracting ontrolling Our Lives, and Taking Over the World*. Cambridge, MA: MIT Press.
Schuessler, Jennifer. 2013. "Philosophy That Stirs the Waters. Interview with Daniel Dennett." *New York Times*, April 29.
Soto, Ana M., and Carlos Sonnenschein. 2020. "Information, programme, signal: dead metaphors that negate the agency of organisms." *Interdisciplinary Science Reviews* 45 (3):331–343. https://doi.org/10.1080/03080188.2020.1794389.
Spielberg, Steven. 2002. Minority Report. 20th Century Fox.
Steinhart, E. 1998. "Digital Metaphysics." In *The digital phoenix : how computers are changing philosophy*, edited by Terrell Ward Bynum and James H. Moor, 117–134. Oxford; Malden, MA: Blackwell Publishers.
Sulemani, Maryam. 2021. "CRUD operations explained: Create, read, update, delete." accessed February 10, 2021. https://www.educative.io/blog/crud-operations.
Thaler, Richard H., and Cass R. Sunstein. 2008. *Nudge : improving decisions about health, wealth, and happiness*. New Haven, Conn.; London: Yale University Press.
Turing, Alan Mathison. 2004. *The essential Turing : seminal writings in computing, logic, philosophy, artificial intelligence, and artificial life plus The secrets of Enigma*. Oxford; New York: Clarendon Press.
Van Bekkum, Marvin, and Frederik Zuiderveen Borgesius. 2021. "Digital welfare fraud detection and the Dutch SyRI judgment." *European Journal of Social Security* 23 (4): 323–340.
Van Fraassen, Bas C. 1980. *The scientific image, Clarendon library of logic and philosophy*. Oxford/New York: Clarendon Press & Oxford University Press.

Wittgenstein, Ludwig. 1969. *On Certainty*. Edited by G. E. M. Anscombe, G. H. von Wright and Denis Paul. Oxford: Blackwell.
Zahavy, Dan. 2005. *Subjectivity and Selfhood*. Cambridge, MA: MIT Press.
Zuboff, Shoshana. 2018. *The age of surveillance capitalism. The fight for the future at the new frontier of power*. London: Profile Books.