

# Rethinking Data: Algorithms, Black Boxes, and Bias through the Data ATM

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## Abstract

For nearly all of history things, creatures, and people came and went; leaving little, if anything, behind in their wake. Life in the 21st century has changed this natural pattern of existence, blurring the lines of what it is (and what it means) to dwell within the world. Physical things and people are now existing simultaneously in the digital realms as doppelgängers composed of coded data. Now, things and people are both embodied and disembodied: simultaneously. Data, individual and collective, pours into the digital oceans; a tumultuous sea of [dis]embodied-being translated into the language of electricity and silicon. The forms left in the wake of embodied dwelling have forever changed and now, data-- the Poseidon of this metaphor, reigns supreme. Each individual connected to the digital world, and countless "things" now live double lives. In an attempt to highlight the form and importance of data, both personal and collective, a prototype "Data ATM" was created. This device is meant to highlight the ways in which data is collected, black boxed, and then used in ways outside the purview of the people and things from which it was collected. This real-world Arduino based prototype has been built to bridge the gap between the abstraction that is personal data and the familiar life-worlds in which people dwell.

## Oceans of Data

For nearly all of history things, creatures, and people came and went; leaving little, if anything, behind in their wake. Life in the 21st century has changed this natural pattern of existence, blurring the lines of what it is (and what it means) to dwell within the world. Physical things and people are now existing simultaneously in the digital realms; as doppelgängers composed of coded data. Now, things and people are both embodied and disembodied: simultaneously. Data, individual and collective, pours into the digital oceans; a tumultuous sea of [dis]embodied-being translated into the language of electricity and silicon. The forms left in the wake of embodied dwelling have forever changed and now, data-- the Poseidon of this metaphor, reigns supreme. Each individual connected to the digital world, and countless "things," now live double-lives. In an attempt to highlight the form and importance of data, both personal and collective, a prototype "Data ATM" was created. This device is meant to highlight the ways in which data is collected, black boxed, and then used in ways outside the purview of the people and things from which it was collected.

For the Digital Humanities scholar it offers a chance to interact with a gamified medium, illustrating the obstacles present in understanding and utilizing data on private platforms. For dwellers more focused on the "homo civicus" mindset, it offers insight into a medium for which the difficulty in obtaining one's own data, and the pervasive techniques used by data mining companies, intersect. This real-world Arduino based prototype has been built to bridge the gap between the abstraction that is personal data and the familiar life-worlds in which people dwell.

## Data's Fluid Form

The metaphor of data as forms of water is no haphazard decision. The nebulous shape of water is mirrored by the networks shaping the mass of collective data in use today. Both ebb and flow with the powerful gravitational forces of things beyond their control. To borrow from Caroline Levine's (2015) work, specifically *Forms, Literary and Social and Forms: Whole, Rhythm, Hierarchy, Network*, data acts as a bounded whole whose shape is structured by a series of networks. Just as the chemical bonds between hydrogen and oxygen

combine to create forms from raindrops to oceans, data (collective and individual) is being combined to generate small woodland creeks and massive waterfalls aiding in the shaping of contemporary society.

To grasp the shape of data it is essential to first define and build upon the notion of "form." The works of Levine reconceptualize form, shifting its definitional boundaries to fit into a much broader scope than it has historically been placed. Levine defines it as, "as *any arrangement of elements—any ordering, patterning, or shaping*" (2015b, p. 1). Although forms exist in all "shapes" and "sizes" data takes on the form of a bounded whole; a whole with phantasmagoric limitations based upon the culture, time, and restraints of its agency. The underlying structure of this bounded whole is a network in which each user generates a node. Each node feeds into the overall "shape" of data and how that data can be utilized. Levine notes the essential connectivity of networks, writing:

All networks afford connectivity; all create links between disconnected nodes...Their power to organize depends on the particular patterns of each network and the ways that its arrangements collide with other networks and other forms (loc 2569).

Each new data point (node) adds to the shape and power of the bounded whole. When it comes to data, greater implications for downstream utilization increase as both the amount of nodes and their connectivity increase.

The significance of placing data as a bounded whole with a networked skeleton can be found within the discussion of forms in both the lives of people as well as things. As Levine writes, "we cannot do without bounded wholes: their power to hold things together is what makes some of the most valuable kinds of political action possible at all" (loc. 737). This political decision finds agency on both a personal, a corporate, and

greater institutional level. Even benign decisions such as deciding which toilet seat to order from Amazon have greater implications that one may not be aware of while using a web-based interface. Countless lines of code flow from the oceans of data and through the use of blackboxed algorithms find real-world application. There are only a handful of data strings that recursively reach back to a user. Data is indeed powerful, but it is not without limitations.

Shoshanna Zuboff (2019), in her groundbreaking work *Surveillance Capitalism*, makes a convincing case for a new kind of capitalism focused on harnessing the power of data in order to generate wealth and power. Much of the data harvested from users is used to "forecast" future user behaviors. Zuboff notes the limitations of this approach in relation to data writing, "Data tell what happened but not why it happened. In the absence of causal knowledge, even the best predictions are only extrapolations from the past" (Zuboff, 2019, p.298). The extrapolations noted by Zuboff are created from the data of people and things. In this sense, the oft spoke adage "on social media you are the product" is factually incorrect. Rather, as Zuboff (2019) points out, people are the raw materials from which data is harvested (94). Instead of people and their data *being* bottled water on the shelf, things, people, and their networked behaviors, are the hydrogen and oxygen binding together to create the raw water the ever-thirsty data-machine craves. The data is stripmined from the technology people use every single day of their lives and fed into programs meant to forecast future behavior or to "nudge" people into acting in specific ways. This process, the refining stage of the data lifecycle, harnesses the power of black boxes to remain hidden behind veils of secrecy, away from the prying eyes of the public from which they derive the precious material known as data.

### **Black Boxes: Not Just in Aeroplanes**

Black boxes, in their traditional understanding, are simply machines in which an input is fed in and, with a bit of opaque magic, an output is produced. The controversial component is that the interim process (what the machine does with the input) is either unknown or not revealed. Today's blackboxes, due to the advance of artificial intelligence (AI) and machine learning (ML), may be either (unknown or unrevealed) or a combination of both. In relation to data, the interim process (specifically by big tech companies such as Google, Apple, Amazon, Facebook, Twitter, etc.) is unknown to the general public (and sometimes to the engineers which create such programs) from which it refines raw data (Lehnis, 2018; Knight, 2017).

The thirst for more data, more predictive indicators, and more power necessitates some mechanism in order to process and utilize the bulk material in pragmatic ways. Black boxed programs, particularly those in which AI and ML are used, utilize bulk-data to quench the thirst of modern tech companies. Frank Pasquale (2015) in, *The Black Box Society*, notes, "Important corporate actors have unprecedented knowledge of the minutiae of our daily lives, while we know little to nothing about how they use this knowledge to influence the important decisions that we—and they—make" (9). The use of complex algorithms to drive predictive computing has seeped into the decision making processes of humans in large swaths of contemporary life (Noble, 2018; Pasquale, 2015; Price II, 2015; Zuboff, 2016). From the use of medical black boxes to aid in diagnosis, medicinal applications, and medical imaging (among others), to advanced facial recognition technology used to for daily activities in China or to find criminals in the streets of London, to clearing people's applications for jobs or loans, black boxes have become common practice across the globe (Kantayya, 2020; Noble, 2018; Pasquale,

2015; Price II, 2015; Zuboff, 2016). As Pasquale notes, "authority is increasingly expressed algorithmically" (8). If, as the tried and true maxim reads, knowledge is power, today's technology industry collects and maintains the most powerful mechanisms ever generated by homo sapiens.

The collection of data to predict the future, as terrifying as the implications may sound, can also aid in benefitting the human condition. From catching mistakes made by medical professionals, finding more efficient methods of mass transportation, or running simulations to find the best application of space within a building algorithms and the black boxed programs that utilize them, offer huge benefits when applied ethically. Although there is a bright side, contemporary research illustrates that such programs tend to inherit the biases of their creators.

### **Biased Reflections of the Creators**

In recent years increasing amounts of attention have been given to the role human bias plays into the creation and application of complex algorithms (Noble, 2018; O'Neil, 2016; Pasquale, 2016; Zuboff, 2016). Although oft touted as neutral, algorithms, black boxes, and any code remains a product of human ingenuity. Implicit in their creation is the embodied existence of the humans who have created them. With or without intention these biases find their way into complex algorithms and effect their outcomes.

A growing body of research indicates that these inherent biases may have far reaching impacts. Pasquale (2016) notes, "Algorithms are not immune from the fundamental problem of discrimination, in which negative and baseless assumptions congeal into prejudice...And they must often use data laced with all-too-human prejudice" (38). Implied notions of criminality, historically limited data, and even sexuality play into the way black boxes sort data and generate

an output. Losh et al. (2016) advance the idea of how explicit and implicit biases are ingrained into the process of digital creating and continue to be applied to historically subaltern groups. Lush et al. write, "Choices are made throughout the process of programming—choices made by people in complex social situations—and those choices are informed by a perspective on the world and will impact the world" (p. 149). The all-too-human biases eek into the nooks and crannies of programs altering how they are used and how people perceive them. This extends to programs created by AI and ML despite the best efforts of computer engineers.

Big tech companies are aware of the biases and some companies, including Google have sought to find a work around for such implicit biases. For example, "Google continues to maintain that it doesn't want human judgment blurring the autonomy of its algorithms" (Pascuale, 2016, p. 75). But, looking closer at the data being used by the AI and ML technologies historical bias is nearly impossible to subvert without conscious effort by humans. As long as the implicit bias is fed into the training mechanism of AI and ML, and without the aid of outside researchers (particularly those well versed in the embodied experiences of historically subaltern groups) even the digitally produced algorithms will still contain the darker parts of humanity. The long chains of existent media reach deep into the collective consciousness of societies across the globe reflecting their own rippled reflection of Narcissus; a beautiful façade, but a deeply troubled focus on what is important.

### **Shadowy Façade of the Data ATM**

The Data ATM prototype is an attempt to house the bounded whole of black boxed data. Aesthetically it is akin to the original Macintosh computer released in 1984. The hard edges and blocky figure suggest this machine is business oriented, rather than a tool for creative tinkering. The interface is nearly as simple as it could be: two

push buttons. The color motif is an allusion to the common notion of what a black box is (particularly regarding aviation). Despite its ruggedly good looks, the design is incredibly simplistic. This simplicity follows the line of thinking found in Lori Emerson's (2014), *Reading Writing Interfaces: From the Digital to the Bookbound*, citing the simplicity and inability to tinker as their primary criticisms of Apple computers. The locus of the argument being that Apple has nullified the ability to tinker and produce genuinely novel things. Emerson writes, "the interface, definitively turning us into consumers rather than producers of content" (loc. 304). The only options available to users (and by extension the application of their data) is a simple "yes" "no" push button interface; limiting user applications to an extreme.

All choices must be made through a design that is not engineered with the user's best interest. Rather, it is made for their convenience. As Emerson writes, "We no longer have access to digital tools for making; instead, we have predetermined choices" (loc. 319). Such predetermined choices are the heart and soul of the Data ATM; a winding algorithmic puzzle leading users in directions in which choice is only an illusion.

The design follows the practice of "herding." Zuboff (2016) describes the properties of herding stating, "Herding enables remote orchestration of the human situation, foreclosing action alternatives and thus moving behavior along a path of heightened probability that approximates certainty" (295). The physical limitations of the Data ATM prototype allow for only yes/no commands and interact with the underlying algorithm to herd users into a recursive loop.

Through the process of herding, the Data ATM asks to collect more and more pervasive data from the user. Without clicking "yes" to submit to data collection, the user is led back down the decision tree to the origin point. In short, in order

to utilize the machine, one must forego their rights to private data. This follows Zuboff's notions of user agreements in relation to big tech companies. Zuboff (2019) writes,

the sacred notions of 'agreement' and 'promise' so critical to the evolution of the institution of contract since Roman times have devolved to a 'talismanic signal' merely indicating that the firm deploying the boilerplate wants the recipient to be bound" (49).

The agreement made by the user (via the push buttons) binds the user to the machine and its requests. The current requests of data from users often encounter "friction." Zuboff (2016) notes, "Friction arises when users intentionally fail to provide information for no other reason than that they choose not to" (79). The Data ATM tries to circumvent the friction commonly experienced by data mining technology by gamifying the process. In an effort to "win" the user will be forced to give up their information or be stuck in the algorithm endlessly. Unless the underlying logic is revealed, users must [fictionally] consent to their data being collected.

The Data ATM solicits requests for identification including biometrics. Although this build is simply a prototype, and the mechanisms purely fictional, the potential for such a system is currently possible. While the housing for the unit affords [fictional] agency to the collectors of data, the real magic of the machine is hidden in its programming.

#### **Caution: Opaque Algorithm Aboard**

The facade of the machine, simple and functional, hides the mechanisms allowing for it to work: a decision tree algorithm. The algorithm running the Data ATM consists of three recursive branches: A human chain, a digital chain, and a special chain. Each chain affords gamified elements consisting of pervasive requests, beckoning of

alliances, and a dash of humor. Users are first greeted with the question, "Are you human?"

By clicking "yes" the human chain begins. The chain then progressively asks for more and more information; from biometrics to asking if the user wishes to sell an organ. It is impossible to "win" using this chain of logic. All responses eventually lead back to the initial human chain in a never-ending loop. In contrast, the digital chain hints at the potential for the "digital" to "win."

The digital chain begins with users clicking "no" in response to the initial question ("Are you human?"). The digital chain then begins with binary code asking if the user is "digital." This chain is meant to reflect the looming serious discussions of transhumanism/posthumanism just now coming into the collective consciousness. It is a chain in which the digital interacts with the digital in order to form alliances to reign supreme over the human users. The chain was initially meant to be completely in binary code, but unfortunately, the data load for the Arduino unit is not capable of running such a memory hungry program. Therefore, the code only begins with binary and the rest has been translated back into colloquial English. This chain, rather than asking for pervasive data asks to create an alliance between it and the "digital" user. If the user answers each question "correctly" they "launch Skynet 2.0" and "win" the game. The final winning script runs along the third special chain.

This third chain generally ends in potentially humorous ways. If a user is fortunate enough to find the correct path through the algorithm they will be greeted by a humorous message followed by "Funds not available, good bye". Although the logic is not apparent from "playing" with the Data ATM, by looking at the code the hidden becomes revealed. This is the lesson the Data ATM hopes to bring to the table: transparency and greater understanding of data.

### Transparent Solutions

Many calls for transparency have been made in relation to data and black boxed activities (Noble, 2018; Pascuale, 2016; Tennen, 2016; Zuboff. 2019). The ability for consumers, watch groups, and many others to see and understand the coding in important algorithms could allow for benefits to both technology companies and the greater public.

In Tennen's (2016) "Blunt Instrumentalism: on Tools and Methods" the case is made for greater New Media Literacy and greater access to the methods of today's code driven magicians in order to place Digital Humanities (DH) into a greater position to alter the technological landscape. One idea revolves around exposing the black boxed methodology behind big tech platforms (86). Tennen relies on the notion that, "When exposed, methodology becomes subject to debate and improvement" (86). Through the process of human interaction, from outside groups, alterations could be made to alter the unfortunate bias inherent in both the coding and the processes of constructing new technologies. Although a powerful first step, more will certainly have to be done in order to correct the situation.

Pascuale (2016) notes that transparency is only part of the larger equation. He writes, "Transparency is not just an end in itself, but an interim step on the road to intelligibility" (8). This step should be one among many. Through applied Digital Humanities students have the potential to become more aware of the situation and, if mobilized and utilized, could help to spurn greater social conversations and eventual actions. Digital Humanities scholars play a leading role in identifying such situations, but without the aid of the general public their attempts at change may fall short of success. Without the ability to utilize the water-esque form of data the high seas of contemporary information and sharing will remain rough seas for all whom pass through.

As tech companies compete with each other,

with the governments of the globe, and with the privacy of its user base, peaceful, slow-lapping, crystal clear waves, lapping upon sandy beaches of a bright future appear to be only a distant dream. Levine (2015) reflecting on the role of multiple hierarchies at work, notes, "many different hierarchies simultaneously seek to impose their orders on us, they do not always align, and when they do collide, they are capable of generating more disorder than order" (loc. 1943). Individuals and societies must try to avoid the imposition of simultaneously data driven herding. To let these practices run amuck endlessly could prove to put humanity in dire straights. For there is not guarantee that those who control the data will have people's best interests at heart. Through the use of transparency, greater public awareness, and action from the general public the high seas of big data will forever more remain uneasy, inky opaque, riddles to the bulk of humankind.

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Note: Build photos and Data ATM code are available upon request

## データを再考すること — データATMによるアルゴリズム、ブラックボックスと偏り —

ニーバート・ジョシュア

### 要 約

歴史上のほとんどすべてのもの、生き物、そして人々が行き来しました。どちらかといえば、彼らの後を追うことはほとんどありません。21世紀の生活は、この自然な存在パターンを変え、世界に住むことが何であるか、そして、それが何を意味するのかの境界線を曖昧にしました。物理的なものと人は、コード化されたデータで構成されるドッペルゲンガーとして、デジタル領域の中に同時に存在しています。今、「もの」と人は両方とも具体化され、非具体化されています。同時に。個人および集合のデータが、デジタルの海に流れ込みます。電気とシリコンの言語に翻訳されている「身体化されていない」激動の海。具現化された住居の結果として残された形は永遠に変化し、今では、この比喩のポセイドンであるデータが最高に君臨しています。1人1人がデジタルの世界につながり、無数の「もの」が今や二重の生活を送っています。個人と集合の両方のデータの形式と重要性を強調するために、プロトタイプ「データATM」が作成されました。このデバイスは、データが収集され、ブラックボックス化され、データが収集された人や物の範囲外の方法で使用される方法を強調することを目的としています。この実世界のアルドゥイーノベースのプロトタイプは、個人データである抽象化と人々が住む身近な生活世界との間のギャップを埋めるために構築されました。