Rhythm and Algorithm: How Rhythmanalysis became Commercialized, Politicised and Weaponised

Julian Henriques

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The contemporary Western world has been shaped if not actually born from the algorithm, it has been said. We live in a computational culture, more specifically an algorithmic culture, as Alexander Galloway pointed out more than a decade ago.[1] One of the excellent New Economics Foundation reports puts it thus: "[algorithms] have morphed from curating online content to curating and influencing our lives."[2] Indeed, capitalism's current financialized mode depends entirely on algorithmic calculation, as the basis of derivatives, high speed trading and the new fintech sector, for example. Platform capitalism relies on algorithmic machine learning and AI, as does manufacturing.[3] Expert systems for medical diagnosis and robot surgery are built from algorithmic machine learning. Political campaigning exploits the micro-targeting of social media messages, as we have learnt from the Cambridge Analytica scandal, not to mention the Snowden revelation of the most extensive government mass surveillance operations the world has ever seen.[4] Pattern of life analysis has been literally adopted in the algorithms of the "kill chain" of drone bombers.

There is now a growing literature on the ills of algorithms on our social, political and economic life, from for example Cathy O'Neil's *Weapons of Math Destruction* or Frank Pasquale's *The Black Box Society*.[5] Also the effects on the individual have been heavily criticised by Jerome Lanier in his *You Are Not a Gadget*.[6] The so-called "techlash" appears to be gathering momentum, with popular TV shows such *Black Mirror* for instance.[7] Indeed one episode of Charlie Booker's Netflix show *Nosedive* has been widely touted by journalists as being prescient of China's currently in-development Social Credit System.[8] Zhima (Sesame) Credit to be fully rolled out by 2020 is an Ant Financial product from the giant Alibaba online retail corporation. As Ed Jefferson has noted that while in *Nosedive* the social media rating was by other people in China it is state or corporate entities that determine your credit status.[9] This is truly the tyranny of the algorithm.[10] Meanwhile London's august V&A museum staging their *The Future Starts Here* 2018 exhibition with the strapline *Could Your Toaster Turn Against You?*[11] The question here is more limited: to what extent has the work of social or human scientists developing rhythm-based methodologies and rhythmanalysis in particular are complicit with the way algorithms have

leant themselves with such alacrity to commercial corporate interest, if not nefarious military ones?

Algorithmic procedures are probably the leading technology in achieving the destruction of ordinary lives that neoliberal austerity requires. The term *technology* is important here, as it lays claim to a deep-seated ideology of the supposed neutrality of these algorithmic techniques. Nothing could be further from the case – algorithms do not express some neutral mathematical truth, rather they are saturated with corporate and / military values, all the better to be so disguised in plain sight under a "common sense" technocratic ideology. This chapter argues the algorithmic processing should be considered as the leading edge of this *technocratism*. Algorithms are the new experts. Evegeny Morozov's calls this digital "solutionism," or Meredith Broussard dubs it "technochauvinism," some years ago Seymour Pappert described as the "technocentric fallacy."[12] To explore these issues the chapter takes several examples to raise some key questions to understand how this might have happened. The examples are Helen Knowles' artwork *Superdebthunterbot*, the use of algorithmic analysis of urban spaces of Amsterdam, the Metropolitan Police Gang Data Base, the Google Urbanism project; then finally the military use of algorithms in the theatre of war.

This chapter compares rhythm with algorithm in order to use the former as a foil against the later. It adopts an approach of thinking-through-rhythm to counter the increasing ubiquity of what amounts to thinking-through-algorithms, which is of course in actual fact how machines operate.[13] It argues that the concept of rhythm can be used to capture some of the human and political values and meaning that the algorithm excludes and thus could provide an important resource for the arts, humanities, human and social sciences research. In short, the values embodied in rhythm as a potential critique and alternative. It is after all the arts and humanities held responsible for the frame of reference for human endeavour – further to what has become the primordial marketable values of "convenience" and "efficiency." The current migrant crisis of the Black Mediterranean makes it only too evident how our humanity is lost when these alone dominate.[14] The relentless hydra-headed beast of austerity makes a difficult target at the local scale. Only in the most extreme instances is there a pushback, for example, with the development of autonomous robot lethal weapons systems such as Google's Maven project, where this came from tech workers themselves.[15] The chapter also points out that rhythm's use as a critical tool is to some extent compromised by the way that Pattern of Life analysis, for

instance, has been hijacked for military surveillance and target identification, as described below.

We begin with some preliminary questions on the similarities and differences between rhythm and algorithm. To start with an algorithm can be defined as a mathematical code that is invisible, distributed, sub-sensorial and embedded in software routines. It is the essential procedure for AI and machine learning. As the performance of a routine such it conforms to the manner in which Wittgenstein recommended we understand words, by asking not about their meaning, but rather what they do. What algorithms do is extract meaning from the data set, that is, refine the raw material of the data set into something that has commercial value. The word *algorithm* combines *algorismus* (Latin) after Muḥammad ibn Mūsā al-Khwārizmī, the Persian polymath in the House of Wisdom in 9th century Baghdad, together with the word *arithmos* (Greek αριθμός) meaning "number." His name Al-Khwārizmī is also the origin of the word digit in Spanish (*guarismo*) and Portuguese (*algarismo*). Al-Khwārizmī is considered one of the founders of algebra, as derived from *al-jabr*, one of the two operations he used to solve quadratic equations as he described in his *The Compendious Book on Calculation by Completion and Balancing* published in 820 CE.[16]

While the power and influence of the contemporary algorithm has come a long way over the last millennia, its operations remain true to this ancient root. In *The Digital Condition*, Felix Stalder locates what he calls *algorithmacity* as one of the three key tenets of this condition (along with *referentiality* as making use of already meaningful rather than raw material and communality, that is, communities of practice). Stalder defines *algorithmacity* as "those aspects of cultural processes that are (pre-) arranged by the activities of machines."[17] As with a google search, for example, these transform the incomprehensible masses of big data into the small data a human being can comprehend. Stalder continues: "they create new dependencies by pre-sorting and making the (informational) world available to us, yet simultaneously ensure our autonomy by providing the preconditions that enable us to act."[18] This gives the algorithms literally a vital role as the lens necessary to see the digital world – without which we would be totally blind. It also raises a host of all-important questions, such as to who are the opticians that prescribe them?

The fact of the matter is that we are totally dependent on our algorithmic instruments to make any sense of the oceans of data. This is the case with our patterns of consumption as it is with scientific research, identifying gravity waves or indeed the "god

particle" of Higgs Boson in the mass of CERN data. The data set is simply impossible to know, it is entirely off the scale human comprehension, making it an excellent example of what Timothy Morton calls a *hyperobject*, though strangely he never mentions the digital domain in this respect.[19] It turns out that one of the best rendering of this data world is provided by Jorge Luis Borges in his short story *The Library of Babel*, published in 1944.[20] "The Universe (that others call the Library) is composed of an indefinite, perhaps infinite number of hexagonal galleries…"[21] are the story's first words. (Google Books some half century later has in fact all but realised this). Borges continues: "the Library is 'total' – perfect, complete and whole – and that its bookshelves contain all possible combinations of the twenty-two orthogonal symbols (a number though unimaginably vast is not infinite)…"[22] Borges tells us that the first reaction to the announcement that the library contained all books was "unbounded joy," but this "unbridled hopefulness was succeeded, naturally enough, by similarly disproportionate depression."[23] And what followed this was absolute chaos and destruction of sections of the library by various fanatical sects. Borges ends the story with the realization: "*The library is unlimited but periodic*… My solitude is cheered by that elegant hope."[24] Strangely enough, this periodic structuring is literally what the recursive nature of an algorithmic routine reveals.

Delving a little deeper into the nature of the algorithm, Robert Kowalski formulated what has become its classic definition, succinctly expressed in the title of his 1979 paper: "Algorithm = Logic + Control." Kowalski states that an algorithm consists of "… a logic component that specifies the knowledge to be used in solving problems, and the control component, which determines the problem-solving strategies by means of which the knowledge is used."[25] Kowalski argues that recognising what he calls the *what* and the *how* as separate functions will improve the efficiency and effectiveness of computer programming. Though he might not be aware of it, to make this distinction Kowalski is in effect arguing against an equally classic definitions of the relationship of these components. One of course is Foucault's famous dictum: Knowledge = Power. Another is Gilles Deleuze equally well-known formulation of control societies, as discussed by Seb Franklin.[26] There is little reason to suppose that what cannot be pulled apart in the actual socio-political world can be severed in the digital domain of code. This obfuscation, of course, is exactly the manner in which the corporate data aggregators and their algorithmic processing platforms acquire its power and influence over human activity in the actual world.

Figure 1 Kowalski's components of an algorithm, diagram

While not taking the logic-control distinction at face value, it does offer considerable value for the present investigation of the relationship between rhythm and algorithm. A similar formula for rhythm would be:

Rhythm = Timbre (Hz + dB) + Periodicity

Here timbre is the complex of frequencies and amplitudes of which every natural occurring sound consists; and periodicity is the frequency of the rhythm, counted in BPM (beats per minute). Periodicity is the pattern or gestalt the rhythm makes. Timbre could therefore be considered as the logic of the sound, periodicity as its control.

The periodic motion of a rhythm necessarily unfolds in time in exactly the same way an algorithmic routine has to do. The distinction therefore comes to be made between logic and timbre, the former a matter of mathematical abstraction, the latter one of sensory experience. Indeed, the complexities and intricacies of the timbre of a sound have so far proved largely resistant to the counting of frequencies and the measuring of amplitudes on which the science of audio engineering is principally concerned.[27] Fortunately the Fourier Transform by which every frequency is reduceable to a sine wave relieves the engineers of addressing such complexities.[28] The issues of power and control are ones under continual discussion in what follows.

Logic and Control

For algorithms execute the routines of which they consist requires constant recursion. Algorithms are periodic in the same manner as rhythms, though not at any human scale, but rather millions of reiterations per second, far in excess of the sensory faculties with which we are endowed. Furthermore, it gets more complicated than that, as McCann and his co-writers describe:

> Whereas historically algorithms would be programmed to complete a task through the input of clearly defined instructions, modern algorithms based on machine learning allow computer systems to create their own instructions

> based on detecting correlations in huge data sets, learning a multitude of ways to complete a task and creating relationships between inputs and outcomes [29]

The consequence of this, as McCann points out is for computers to be able to take on tasks that previously would have been reserved for human operators. Most important, the nano scale and speed, multiple authorship, system wide distribution and autopoietic learning of algorithmic operations certainly remove them from human purview. It is literally the case that no human being can answer the question as to what was the "suspicious activity" that triggered your credit card to be stopped. Such decisions have been entirely outsourced to pattern-detecting algorithmic processing. This has made it very easy for the corporate entities who develop, own, run and make vast profit from the servers running these algorithms to claim that they are somehow legally beyond their corporate responsibility. This is of course the defense of denial that trips so readily from the lips of Zuckerberg et al when they cannot avoid official questioning from government enquiries.

These issues of power and responsibility are precisely those raised by Helen Knowles' video artwork *The Trail of the Superdebthunterbot*.[30] The 45 min video was filmed in Southwark Crown Court and cast from legal experts. The artist describes the premise for the work as follows:

> In a fictional plot, Superdebthunterbot sees an unscrupulous debt collection agency buying the debts of students across the UK, and then using unconventional means to ensure there are fewer defaulters. Through the use of big data, individuals are targeted and constantly shown job adverts, so more money gets paid to the debt collection agency once the students sign up to a job.

The drama of the piece comes when "in a tragic twist, two young people die after taking part in a risky medical trial advertised to them through the algorithm." This leads to the question:

> Is the algorithm culpable? If Superdebthunterbot has the ability to self-educate, learn, and modify itself independently of humans, can it be found

guilty of manslaughter if someone dies as a result of its actions? Can rigid legal rules apply to something that's essentially abstract?

It is precisely the nature of the status of an algorithm as a self-learning software routine that makes it comparatively easy for the corporations to evade their responsibilities.

Figure 2 Courtroom sketch by Liza Brett to document Helen Knowles' video work *The Trial of the Superdebthunterbot* (2015)

These issues of responsibility of and for algorithms can be theorised in terms of Saussure's semiology where the signifier forever floats above the signified never to be tied down to an actual object. In a way this is what Knowles is searching for – the proverbial *point de caption* (upholstery button) where the signifying code meets the signified reality. In Lacanian theory this is the phallus, but in the courtroom not even death provides a sufficiently secure linkage between the code and its consequences. Again, arts and humanities research and theory can be held to bear some responsibility, in so far as one of the principle drivers for structuralism was to secure its status as the *science* of language, allowing the social sciences at long last to become such.

In the respect the algorithm can be considered as the ultimate floating signifier, or more precisely Guy Debord's *simulacrum* – the copy for which there is no original. This is becoming increasingly the case on account of "self-learning," "deep-learning" and "unsupervised" algorithms defined entirely by their functionality without ever being able to know how this is achieved. In addition, as Stalder states: "The world is no longer represented; it is generated uniquely for every user and then presented."[31] This erosion of any truth value, or any correspondence of representation with the actual world all to readily bleeds into the actual world via the echo chambers of fake news. This provides a fitting description of the algorithm-generated financial instruments entirely untethered from any real-world assets, or the digital platforms across which global corporations sell meals, accommodation and transport etc. In every instance the outcome of this "escape into code" facilitates the avoidance of responsibilities to consumers, to employees or as tax-paying corporate citizens.

Algorithmic automation

In principle the algorithm can be considered as no more than a mechanization procedure, informational automation, outsourcing calculation processes to a machine. The abacus and the slide rule are two such instruments, but it was not until Babbage and Lovelace's difference engine as the progenitor of the computer that such procedures became fully mechanised. As it well-known, this was on the basis of the mechanisation of the previously entirely manual weaving process as was first achieved with the Jacquard loom in 1804. The great leap that Babbage and Lovelace made was to mental calculations as mechanical operations. The wheel may be an extension of the foot, as McLuhan put it, but it operates on the principle of rotation, rather than bipedal locomotion. Similarly, the repetition of an algorithmic routines are design plays to the forte of machines rather than human capacities. It is not that human operators have been saved from repeating routines of repetitive work, far from it, as Anson Rabinbach details.[32]

The factory assembly production line was literally the engine of the twentieth century's industrial revolution, pioneered as it was several hundred years earlier in the slave plantation economies of the Caribbean colonies.[33] The assembly line's partial mechanisation of manual tasks relies on exactly the same principle as the calculations performed by the algorithms – breaking down a large complex task (previously accomplished with a comprehensive range of craft skills and experience in a workshop) into a long series simple routines and sub-routines requiring only a minimum of skills training for human operators.

It is of course the remaining human operators that the current wave of factory automation – depending of course on the algorithmic machine learning – is set to replace. "Everything feels like the future but us" is the comment of one of the workers in Elon Musk's Tesla robot-run car factory.[34] The march of mechanisation is hardly novel, as Siegfried Gideon documents in his *Mechanization Takes Command*.[35] It's progress was compiled by the Encyclopaedists Denis Diderot and Jean le Rond d'Alembert's huge *Encyclopedia, or a Systematic Dictionary of the Sciences, Arts, and Crafts* published between 1751 and 1765. Enlightenment thinkers were fascinated by the mechanical in the manner we currently are with the digital. Jacques de Vaucanson's defecating mechanical duck of 1739 was a hugely popular attraction.[36] Julien Offray de La Mettrie's treatise *Man a Machine* crystalized these thoughts originated a century earlier by Descartes.[37] Not that

this march of mechanization did not also inspire significant foreboding, as brilliantly articulated by Charles Babbage in his prophetic *Ninth Bridgewater Treatise* of 1838.[38]

Repetition

The link between rhythm and algorithm arises from the fact that both unfold in time, that is, are rooted in periodic movement of reiteration, repetition, recursive motion – the refrain. A rhythm repeats itself, turning a random event into a meaningful pattern. This was Pierre Schaeffer's great discovery with *musique concrète* in the 1940s where he essentially invented the loop.[39] The tape loop transformed mere noise into what could be appreciated as a musical sound, simply by the act of repetition, without any further effects. This can be taken as an example of what Jacques Attali describes as the prophetic function of music; rhythm anticipates alogorithm.[40] Sounding anticipates forms of social organisation, as the division of labour of the symphony orchestra anticipated the factory assembly line, according to Attali. The concept of rhythm can of course be traced back to antiquity and this is exactly what Pascal Michon does in his *Elements of Rhythmology*.[41] As most relevant for the algorithm, rhythm is best identified in relation to *rhythmos* as defined by Emile Benveniste as the *form* and *flow* and to rhythm as deployed in Lefebvre's rhythmanalysis, as detailed elsewhere.[42]

Despite being at the heart of industrial progress, the idea of repetition has not had a good press as far as Western philosophy is concerned. Repetition has traditionally been considered as the anathema to Western civilization itself, as Achille Mbembe discusses.[43] Indeed Hegel states this quite explicitly; James Snead details this.[44] Africa, Hegel contended was the Other against which Europe could define itself. Africa could not be considered as capable of achieving any form of civilization and continual repetition was indicative of the lack of progress that made Europe the superior. Again, the Western Avant Garde musical tradition is at work to rehabilitate repetition as a positive aesthetic with minimalist composition techniques developed by Steve Reich and Philip Glass.[45] This goes against the grain not only African prejudices, but also the Modernist Romantic idea of artistic creativity as being born from originality. It turns out the repetition in music is in fact a complex matter further to the mechanical meter of the drum machine; it revolves round minute variation to increase the listeners anticipation and thereby involvement with the music, as Matthew Butterfield explores.[46] This is the essence of the groove.

Different Scales

What then are the significant distinctions to be made between rhythm and algorithm? One is evidently a matter of scale and speed of operation, between big data and small data, so to say. Another is ownership, as a rhythm is shared in a musical tradition, whereas an algorithm is often a corporate owned trade secret. Rhythm and algorithm also differ from each other in terms of the age-old dichotomy between qualities and quantities. Rhythm is expressed, in human practices and techniques of for example *musicking,* as Christopher Small describes them.[47] These consist of the fully comprehensive range of activities that are required not only to produce, but also give the qualities of meaning to what traditionally we understand as a musical performance. Generating meaning requires human attention and human values; it is a reciprocal process that resides in the relationships which of course often involve signs, codes and objects, but can never be reduced to these alone. Non-representational meaning that is *presented* in the embodied expression of gesture or intonation can only be *re-presented* in linguistic codes.

Algorithmic processing, by contrast, is a strictly electro-mechanical, the pure logic and control of code, procedural rule and routine without content or meaning. As with machine learning, it is something on which computing machines can operate incredibly fast and efficiently, but entirely beyond our ken. It is only concerned with what can be quantified, the difference between input and out, or classical stimulus and response, with absolutely no concern for what are considered to be the essentially unknowable processes in between. The algorithm is entirely a behaviourist tool only ever measuring what, incapable of ever considering why in procedures that Antionette Rouvroy has dubbed "data behaviourism."[48] Thus not only is the algorithm itself a black box, on account its autonomous learning mentioned above, but "for algorithms, people are black boxes that can only be understood in terms of their reactions to stimuli."[49] In this respect the algorithm-rhythm distinction is aligned to that between mechanical meter (takt) and expressive rhythm. Of course, it is only too evident that the ever-increasing intensities of data extraction operate without the slightest need for meaning. As Yuval Noah Harari succinctly describes the project of Modernism: "humans agree to give up meaning in exchange for power."[50]

This is perhaps one of the respects that the human and social scientists are to some extent culpable for the shortcomings of the algorithms – not so much by commission but as by omission. For the first half of the twentieth century human sciences were in the thrall of the so-called hard sciences, principally physics. B. F. Skinner's "black box" psychology of behaviorism was one of it's at-the-time successes – since entirely

abandoned in favor of cognitive psychology – until that is, the recent rise of CBT (Cognitive Behavior Therapy). The young Sigmund Freud was not immune from this scientism with his early *Project for a Scientific Psychology* of 1895. It is even possible to pinpoint the pivotal moment when the tide turned in favor of science as the final arbiter of truth and meaning. This was on 6th April 1922 with the famous debate between Einstein and Bergson, where the mechanistic scientist was widely considered to have won the argument over the philosopher's speculation and introspective methods.[51]

Then perhaps recognizing its limitations, in mid-century favor turned to cybernetics and engineering as the new models for scientific reductionism. For cybernetics communication and control are one and the same, as Felix Stalder discusses.[52] From this Shannon and Weaver's Information Theory was born, this is to say, a theory of communication as *engineering* and thereby only concerned with probabilities and signal to noise ratios – with nothing to do with the meaning (let alone knowledge, understanding, or wisdom).[53] There were very few exceptions mounting any critique of this idea that communication could simply be reduced to information. George MacKay and Gregory Bateson were two critics at the time in the 1950s, another more, recently is James Durham Peters.[54] Otherwise human scientists, now speaking the language of structuralism, abandoned the field communication to the information theorists. This is in effect returning communication to the fold of behaviourism whose data outpourings are currently being devoured by the algorithms. The fact that this has proved to be so effective as a business model for selling products, services and propaganda means that the idea of meaning has become literally surplus to requirements.

City Rhythm

It was against this same mid-century background that Henri Lefebvre's rhythmanalysis has its appeal. Here at last was a human scientific methodology – human because it concerned rhythms and scientific because these could be counted. As the genealogy of rhythmanalysis has been quite fully discussed elsewhere we can proceed here with a current example of the use of rhythmanalysis.[55] This comes in the form of a recent study *City Rhythm: Logbook of an Exploration* by Caroline Nevejan, Pinar Sefkatli and Scott Cunningham.[56] The study was commissioned by the Amsterdam municipality for the purposes of civic planning. Most importantly, it serves as a contemporary example of a non-commercial and non-military deployment of rhythmanalytical methods, bringing Lefebvre's approach up to date with the computer modelling of large data sets.

The authors conclude optimistically that “rhythm analysis, in the physical world as in the related data domain, offer a potential new approach for policymaking.’[57] In the course of their investigation they refine the rhythmanalytic method by distinguish between three scales: *beats*, *base* and *street rhythms*. Working with a grid of 500-meter squares:

> Beats are defined as the state of a specific area at a specific moment in time. As an example of a state, a street might have lots of cars, a few cars, or no cars at all. Street rhythms show significant transitions over time for a specific area. The base rhythm of an area is defined by comparison to other areas. These derived rhythms are like a musical meter. In this specific context, individual street rhythms develop. Street rhythms represent a variation around a few specific themes.[58]

While the authors state they are “interested in understanding the dynamics of cities through the use of large data sets, in order to draw conclusions for *social safety* [my emphasis]” they also recognise it is equally valuable commercially for “asset data or streaming data, because it connects the datasets in order to display the ground rhythm of neighbourhoods.”[59] It is this commercial exploitation that the rhythmanalytical methodology is powerless to prevent which of course is what makes it so attractive to Google Urbanism, as discussed below.

Figure 3 *City Rhythm: Logbook of an Exploration*

Rhythmic Appeal

The periodic motion expressed rhythmically (as well as algorithmically) as an energetic and time-based understanding of the world appears offer a progressive potential. This is in so far as any critical approach has to imagine that things could be different from the status quo of fixed objects. Periodic motion is aligned with an events and processes of an energetic materialism, as against the tradition Newton mechanical view of the world of self-identical objects and external forces. This is a crucial epistemological shift from the idea objects to that of *relationships* – as this is where a pattern resides. In the terms of the ancient Greek philosophers the idea of rhythm aligns itself to Heraclitus who taught all is flux and permanence an illusion, as against Parmenides for whom it was the opposite; change was the illusion. This is the appeal of rhythmanalysis. So it came as a shock to find that the periodicity of rhythmanalysis that I had been assuming was inherently critical

and progressive, was in fact equally capable of being purposed for completely different ends. It is not without irony that far from periodic movement of the algorithms underpinning change, they are being used to cement together the new capitalism order.

This is not to subscribe to the view that the algorithm is a neutral mathematical code that can be used or abused. Far from it, as with every other technology, instrument or technique, the algo is deeply embedding with politics, culture and ideology, as Jonathan Sterne's in-depth investigation of the MP3 file format.[60] Software is never neutral, but has to be socially and historically located. As Louis Chude-Sokei argues in The *Sound of Culture*, technology is always raced and sexed.[61] Evidence against such a Panglossian view of technology appears to be mounting, not least on the basis of the facility with which the algorithmic tools at the basis of Facebooks' business model have been exploited for political ends as Carole Cadwalladr has done so much to expose.[62] Also, it should be remembered that there is a continual traffic between military and entertainment industries, as with VR technologies, or indeed Hedley Jones', the inventor of the Jamaican sound system, re-purposing is his RAF radar engineering skills for sound system design.[63]

Racial Profiling

Algorithmic processing is anything but value-free. In fact, it tends to reproduce prejudices of the society at large – and in many instances exacerbate them. It is as if what is repressed by the value-free technocratic ideology takes the first opportunity to rush back into the picture. This is what Safiya Umoja Noble found in respect to Google searches for "why are black women so…" as detailed in her *Algorithms of Oppression: How Search Engines Reinforce Racism*.[64] As we have learnt about the "echo chambers" of social media, the algorithms are primed for attention-grabbing extremes, to aggregate and amplify like-minded viewpoints. Unfortunately, the amplifying effects of algorithmic analysis is not restricted to the racial prejudices of search engines and social media.[65]

The Metropolitan Police Service Gangs Violence Matrix become operational in 2012 in the political wake of the riots in London the previous year. The Matrix is a database and "a risk-assessment tool to assess and rank London's suspected gang members according to their 'propensity for violence'."[66] Those on matrix are known as 'gang nominals' and each marked as red, amber or green level of risk of committing a violent offence. In 2017 the Matrix included 3,806 people. The Amnesty International report *Trapped in the Matrix* accuses the Met of a "racialized" war on gangs. It paints an entirely damning picture:

> Our research shows that the Gangs Matrix is based on a vague and ill-defined concept of 'the gang' that has little objective meaning and is applied inconsistently in different London boroughs. The Matrix itself and the process for adding individuals to it, assigning 'risk scores' and sharing data with partner agencies appears to be similarly ill-defined with few, if any, safeguards and little oversight.[67]

The report continues:

> Not only does this data collection amount to an interference with young people's rights, but the consequences could be serious for those labelled as 'gang nominals', more than three-quarters of whom are black boys and young men.

Included in the report are comments from those interviewed including Martin Griffiths, Trauma Surgeon at Royal London Hospital, who states: "The Matrix is not fit for purpose, never has been, never will. It feeds an industry based on violence reduction...distorted to fit a narrative: All knife crime is committed by young Black men in gangs."[68] Griffiths goes on: "You put that child on the matrix, you wrote that child's future. There are no second chances in this society for poor Black kids."[69] The algorithmic analysis software assigning automated "harm scores" to those on the Matrix was developed by the Metropolitan Police themselves, rather than any third party.[70]

Pattern analysis

On the basis of their shared periodicity a further common feature of rhythm and algorithm is that they both revolve round patterning. Pattern detection is precisely what the algorithms are designed to do as unrefined data has only the potential of commercial value. An entire industry has been built on this model with firms like Experian Mosaic using "geodemographic" algorithmic techniques to locate and target consumers in their home neighbourhood, thus further undermining the pre-digital advertising industry model. At the broader scale such patterning is indicative of a key characteristic of the human condition – trying to make sense of the world; on the whole animals and plants do not have to do this. Making sense of the world requires organizing it – finding the patterns, distinguishing

between similar and differences. This patterning is often done in time, that is, in a linear sequence. With representation the principle tool for this has always been story-telling. With non-representational material then this is rhythm which is linear, polyrhythms in parallel.[71]

Such patterning can also be arranging physical objects as a visual gestalt. Both are patterning techniques, one in time, the other in space. Essentially patterning emerges from the relationship between things, rather the things themselves. Unlike machines, such relationships are limited by our human perceptual faculties. In the 1950s cognitive psychologist George Miller famously identified human short-term memory capacity as being 7 individual objects + or – 2.[72] In terms of the pattern itself, according the principles of Gestalt Psychology there are six characteristics *proximity, similarity, closure, good continuation, common fate* and *good form*. Most importantly, Kurt Koffka recognised the non-reductive principle essential to the nature of a pattern: "The whole is *greater* than the sum of its parts."[73] This is to say patterning relies on relationships of difference. This critical insight has been most eloquently expressed by Gregory Bateson: “The *pattern which connects is a metapattern*. It is a pattern of patterns. It is a metapattern which defines the vast generalisation that, indeed, *it is patterns which connect*.”[74] This takes us back to the distinction between rhythm and algorithm: “Quantity is measurable and comparable to similar others, but it cannot be exact. Quality, like class or number, is not measurable,”[75] Bateson tells us. For practical purposes however, the sheer quantity of the big data set interrogated algorithmically crosses the divide between quantity and quality; it finds the needle of pattern in the haystack of data. This has always been the ambition of the soothsayers – to find the pattern that predicts the future from the pattern of the runes, tealeaves, entrails, tarot cards or whatever.

Rhythms and algorithms have different relationships with patterning. Rhythms make patterns, algorithms find them, in short. Rhythms gather together events, assemble them, group as a gestalt in time. This key characteristic of the nature of human activity – as captured in rhythmanalysis – that it is never metric or linear. In this respect a rhythm is an aggregator. This of course is a rather different use of aggregation compared to the data aggregation that is the *modus operandi* of the platform capitalist corporations. It is of course these data sets on which they set the algorithms to work to discover. That is exactly what they do continuously at a scale and speed that by far exceeds any human sensory or comprehensive faculties.

In addition to their apparent commonalities there are some less obvious similarities between rhythm and algorithm to be uncovered. Rhythmic inflection has origins in the periodic motion of human practices and techniques, whereas algorithms have theirs in those of mathematics. Despite the fact that mathematics has traditionally prides itself on being purely an activity of the mind, removed from the real world of embodied activity, in actual practice this not the case. As André Leroi-Gourhan has argued that language has to be considered as evolving from embodied gesture.[76] In short, mind and hand co-evolved. More recently Brian Rotman applies a similar argument specifically to the language of mathematics itself.[77] He claims that the fundamental mathematical activity of counting has to be considered as being derived from the embodied gesture of counting objects in the actual world.

Sites of Extraction

It appears as if the lack of human values only accelerates the need for the extraction of commercial value from the data sets. The first territory for algorithmic extraction was the personal, with smart phones, internet searches and wearable self-monitoring gadgets such as Fitbit. Now the terrain for extraction is expanding to the domestic sphere with the smart home that can boast, streaming entertainment services, Hive heating control, or Nest IQ advertised as "the clever thing for your everything," for example. Awaiting the arrival of the much anticipated IoT (Internet of Things) are the Google Home and the Amazon Echo and Show Alexi listening devices. As Jonathan Albright comments:

> Echo signals the coming wave of ambient "life interfaces." It represents yet another opaque technological layer that mediates our lives—shaping the information we share with companies, how this data is used to model our behaviour, and the information, ideas, and products that we encounter as a result… With Echo, Amazon has ushered in the first of what is arguably a new class of interface, "cloud furniture," that is able to engage multiple users in *shared* interaction at the *group* level.[78]

What is always striking about all these devices both personal and home-based is the extent to which the ideology of convenience holds such sway that we are not only prepared to give all our data for free to the aggregator corporations, but also happy to pay for the devices that do this for them. We literally subscribe to the digital panopticon. The

question be raised here is what happens to the subjectivity of the user when he or she is transformed into the "product" of these "free" services?

Google is preparing to conquer the further frontier for extraction beyond the domestic interface. This comes in the form of the Google Urbanism project – a very different concept and stark contrast with Amsterdam's Rhythm City. Nevertheless, it deploys exactly similar algorithmic data harvesting techniques. The new site for extraction is our very presence in public spaces. The Google website asks: "Why 'presence' in public spaces should generate financial returns for the city, and how Google can help…"[79] This Google project, the brainchild of a group of final year students at the Strelka Institute in Moscow, provides a telling indication of the global corporation's "Speculative Expansion Strategy for Google in Physical Space." [80]

Figure 4 Google Urbanism project

An interview with one of the project team Nicolay Boyadjiev with the Denisse Vega de Santiago and Leonardo Dellanoce from the architecture journal *Archis* provides some insight into the thinking at the core of the project.[81] This is: "the conception of a legal infrastructure (the 'license') and value-tracking protocol strategy" that is of course for harvesting value and data. Importantly this is "implemented not for the physical construction of episodic signature objects/ environments" as with pattern of life analysis (discussed below with reference to drone targeting) "but for the systemic, ongoing maintenance of uneventful real spaces of the city…" Boyadjiev continues: "In the project, public space goes beyond its traditional confinement as a 'backdrop for human activity' and moves to the foreground as the main subject, the legal holder of human 'presence' as its raw material." This presence is defined as "attention and data."

The key claim of the project is that under the terms of the license Google promises to return some of their profits as investment in the physical infrastructure from which they have harvested the data. As Boyadjiev puts it the value of this presence "extracted from public space in the city is [then] tracked, the resulting financial micro-transactions are accounted for, and part of their returns are reinvested in their spaces of origin in the form of dividends for public space's ongoing maintenance and improvement." Thus, the Google Urbanism project proposed to put the agora firmly in the pockets of the aggregators. Gone is any idea of public space as a shared commons, banished any local political structures, processes or accountabilities, vanished is any idea of citizen or citizenship. Instead there

only consumers, such that "users as raw material, [are] no longer an end in themselves; instead they become a means of profit in a new kind of market place."[82] Instead there are only individual patterns of consumption and a grotesque public-private partnership of the kind that has historically in the UK proved to benefit only the private sector at the expense of public. Google Urbanism provides a vivid example of what post-democracy looks like.[83] It should also be added that the austerity-ridden local councils might well be forced to consider Google's offer partly as a result of that corporation's own tax-evasion that has helped starve the government of revenues. Thus, the scene is set for Google's next algorithm-assisted power grab.

The Kill Chain

Many of the issues raised so far find extreme expression in the military application of algorithmic calculation, the final example. Historically armies have an interest in rhythm with marching bands and drills to march in step.[84] The patterning that rhythm provides is currently being exploited as a tool to identify targets in the drone kill chain by making sense of the vast amounts of data currently available to the military analysts. As Grégoire Chamayou describes this patterning is already being made us of – by the military, in terms of activity-based intelligence (ABI).[85] This is a new methodology for targeting drone attack by aggregating all forms of intelligence (Geoint, Sigint, Osint, Masint, Humint) into a big data set applying ABI algorithms. As one military strategist Chandler Atwood states:

> … ABI methodology enables analysts to sift through large volumes of varieties of data to see how the data overlap and intersect, identifying associations and enabling significant events to rise above the noise of data triage… After the ABI analysts commingles the various pieces of data and identifies key pieces, exploitation begins within each INT, providing the results to the multi-INT analysts to conduct integrations of the exploited information and address the intelligence questions as the process continues to add additional information."[86]

In this way "*activity becomes an alternative to identity*."[87] It is no longer then individual enemy agent that needs to be identified and destroyed, but rather a pattern of activity identified as potentially threatening. Gregory: "Essentially, the task consists in distinguishing between 'normal' and 'abnormal' activity in a kind of militarized automated rhythm-analysis that takes increasingly forms."[88] "Signature strikes" as they are called, rely

on these patterns of behaviour rather than a known named target as such.[89] Gregory refers to such patterns of life explicitly as a "militarized rhythmanalysis." [90] The implications for military strategy of this type of analysis are explored in Brian Massumi's *Ontopower: War, Powers and the State of Perception*, though he does not discuss ABI as such.[91]

Figure 5 ABI diagram

The shift in military strategy that the algorithmic processing of data facilitates, according to Neal Curtis' analysis is "the explication of the social [by the] drone apparatus – the combination of UAVs, satellites, cameras, servers, and algorithms…" Curtis continues:

> Algorithms and the programming of code therefore become absolutely essential for the handling and negotiation of such massive amounts of information. Importantly, and partly because computation has enabled the greater extraction and archiving of data, these algorithms no longer simply serve the apparatus but are set to take on more of the difficult hermeneutic task currently designated to the drone operating team.[92]

This is a *social* strategy marking a departure from the former targeting of the *physical* environment of the enemy, as Peter Sloterdijk describes in *Terror from the Air*.[93] Curtis: "Drone war is presented as a move away from and a moral advance on the earlier weapons that directly targeted the environment as an indirect means of killing the enemy."[94] He explains:

> What is targeted is not so much the individuals that Predator or Reaper drones assassinate as the determination of 'patterns of life' suggestive of hostile intent… when everyday habits and routines become signatures that trigger a strike…The target is… the quotidian social patterns and minute divergences from those patterns that are suggestive of a terrorist threat.[95]

Curtis' conclusion:

> What I believe the apparatus of the drone does: *strategically, the intention is to destroy the world of the terrorist by means that make the world technically*

> *explicit, targetable and hence unliveable…. This is why the apparatus of the drone is the perfect weapon, because it joins the strategic aim of world-breaking with the technical means of world-capturing.*[96]

This idea of world capturing also describes personal, domestic and public worlds, as described in previous sections above.

Pattern of Life analysis is another social scientific concept that has been militarised. This type of relational analysis now used with big data all-source analytics was developed in Anthropology with for example Ruth Benedict's *Patterns of Culture*, or Clifford Geertz' *Thick Description* where he writes, "meaning varies according to the pattern of life by which it is informed."[97] He continues:

> Behaviour must be attended to, and with some exactness, because it is through the flow of behaviour – or more precisely, social action – that cultural forms find articulation… these draw meaning from the role they play… in the ongoing pattern of life, not from any intrinsic relationships they bear to one another.[98]

This also congruent with Bourdieu's conception of habitus that describes of the dynamics and dispositions.[99]

Like rhythmanalysis, Pattern of Life analysis is concerned with extrinsic relationships, that is behaviours, rather than objects.[100] It has been transformed from an anthropological term to a military one, amalgamating algorithm and biology, as Joseph Pugliese explains:

> The military term 'pattern of life' is inscribed with two intertwined systems of scientific conceptuality: algorithmic and biological. The human subject detected by [the] drone's surveillance cameras is, in the first scientific schema, transmuted algorithmically into a patterned sequence of numerals: the digital code of ones and zeros. Converted into digital data coded as a 'pattern of life', the targeted human subject is reduced to an anonymous simulacrum that flickers across the screen and that can effectively be liquidated into a 'pattern of death' with the swivel of a joystick.[101]

The algorithmic procedures used by the military, Elke Schwarz explains in an analysis of what he dubs "prescription drones," are identical to medical ones. These

are “based on probabilistic factors, identifiable characteristics, and physiological or psychological knowledge linked to higher-risk categories, algorithms are conceived to identify high-risk groups and individuals,”[102] thus affecting what could be called a moral anesthetic as to their consequences. Schwarz continues, “Signature strikes echo the biomedical practice of risk profiling and surveillance with a view to prophylactic intervention.” But unlike much medical intervention, it has to be pointed out, such intervention in the theatre of war in Syria, Iraq and Afghanistan are very far from accurate. In Syria, civilian deaths increased by 55% to 8,051 between 2016 and 2017, as has been widely reported.[103]

Against such evidence, “the techno-biopolitical assemblage of expertise in targeted killings by drones,” Schwarz concludes: “… rests on a form of algorithmic governmentality, facilitated through the technical capacity of the drone as an agent of expertise.”[104] The issue is importantly one of values:

> … the drone appears as able to ‘act’ not only better than humans, but also more ethically. This *algorithmic logos*, however, is also reliant on a rendering of the body politic in anthropomorphic terms, as a body in need of a cure.[105]

But the medicalized body is far from safe. The non-values of the algorithms administer the most evaluative of all decisions, that is, the sovereign power of the State to take life, *bare life* as Gorgio Agamben describes it.[106] This is the outcome of the *algorithmic logos* or thinking-through-algorithms, as named above – a contradiction brilliantly captured in the title of Arthur Jafa’s video work, *Love is the Message, The Message is Death.*[107] To the extent that rhythmanalysis and PoL might have succeeded in contributing to a richer understanding of human life, as militarized algorithms they are currently facilitating death.

Figures

Figure 1 Kowalski’s components of an algorithm, diagram

Figure 2 Courtroom sketch by Liza Brett to document Helen Knowles’ video work *The Trial of the Superdebthunterbot* (2015)

Figure 3 *City Rhythm: Logbook of an Exploration*

Figure 4 Google Urbanism project

Figure 5 ABI diagram

Figure 6 PoL

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