Rhythm, Rhythmanalysis and Algorithm-Analysis

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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: "[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]

At the same time there is also a growing critical 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 would be considered by many as the tyranny of the algorithm.[10]

In this quite broad context the questions entertained here are comparatively limited. Two questions are raised around rhythm. One is to what extent does rhythm count as a common root for rhythmanalysis as a social scientific methodology on the one hand and on the other algorithmic data extraction procedures? The other question is can rhythmanalysis provide the basis for a critique of the application of algorithmic methodologies, that is, an algorithm-analysis? To attempt to find some answers the chapter takes several examples: Helen Knowles' artwork *Superdebthunterbot*, the use of

algorithmic analysis of urban spaces of Amsterdam and the Google Urbanism project; the Metropolitan Police Gang Data Base; then finally the military use of algorithms and Pattern of Life analysis in the theatre of war.

Algorithm: Logic and Control

Algorithmic procedures are undoubtedly the leading technology for the social, political and economic revolution of which we are in the midst. 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 / or 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."[16]

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-[17]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.[18]

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."[19] 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."[20] This gives the algorithms literally a vital role as the lens necessary to see the digital world – without which we would be totally blind.

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.[21] It turns out that one of the best rendering of this data world is provided by Jorge Luis Borges "'total' – perfect, complete and whole" *Library of Babel*.[22]

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."[27] Kowalski argues that recognising what he calls the *what* and the *how* as separate functions will improve the efficiency and effectiveness of computer programming (Figure 1). While this may be entirely uncontentious in computer science, it runs counter to much social sciences and humanities research. Here the effort has been to relate rather than separate logic and control, that is, knowledge and power, as with Foucault's famous *power-knowledge* formulation, or Deleuze's equally well-known concept of control societies, as discussed by Seb Franklin.[28] It appears that what cannot be pulled apart in the actual socio-political world in the digital domain of code can be severed with alacrity. Obfuscation on this point is of course is exactly the way in which the corporate data aggregators and their algorithmic processing platforms acquire its power and influence over human activity in the actual world. 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.
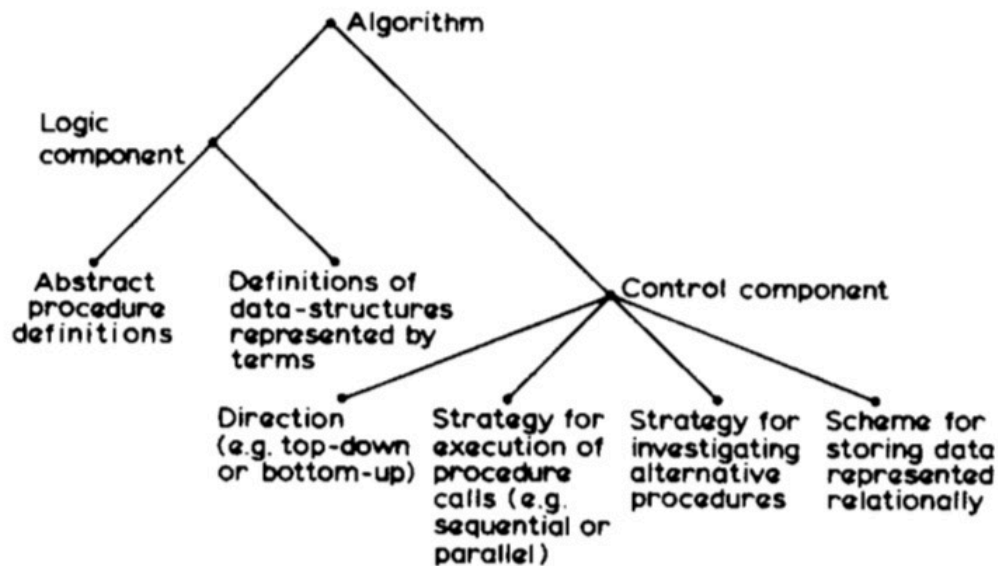
Figure 1 Kowalski's components of an algorithm

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 [30]

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, and run the servers running these algorithms to claim that they are somehow legally beyond their corporate responsibility.

Rhythm: timbre and musicking

The periodic motion of a rhythm necessarily unfolds in time in exactly the same way an algorithmic routine has to do, 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. This is to say both are rooted in periodic movement of reiteration, repetition, and recursive motion – the refrain. A rhythm repeats itself, turning a random event into a meaningful pattern. This was great discovery the tape loop. While this is usually attributed to Pierre Schaeffer's *musique concrète* in the 1940s in fact this innovation should be attributed to the Egyptian composer Halim El Dabh several years earlier, as Fari Bradley evidences.[31] The 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, so in a way, rhythm anticipates algorithm.[32] 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*.[33] 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.[34]

Besides issuing from repetition, both algorithm and rhythm are sociocultural accomplishments, both are articulated on the basis of codes and both require technologies (biological instruments of vocal chords etc. or mechanical ones) and techniques, in order to operate. There has never been a hard and fast division to made between human and machine; culture requires techniques, that is, instruments and technologies. Flint axe-heads occupy this role as much as cyborg prosthetics. Thus the distinction between rhythm and algorithm is certainly not that between human and machine, or analogue and digital, as neither can make sense without the other.

With so much in common one way of characterizing the relationship between rhythm and algorithm would be as that between spoken and written language. This might

help to avoid any over-simplistic binary between human rhythms and machine algorithms; rather it might suggest how one leads to the other, as well as ways to use rhythm to better understand algorithm. Ferdinand de Saussure's classic distinction between a particular spoken utterance (Parole) and the general language system (La Langue) on which he founded the science of linguistics is even more marked in respect of written text of the language system. Ephemeral utterance is transformed long-lasting and reproducible text. This can be said without wishing to claim a special privilege for oral traditions against dominant written cultures, as the early theorist, such as Walter Ong, invariably did.[35] Notwithstanding Derrida's critique of phonocentrism, we can assume that writing records speech that proceeded it, in the manner that Albert Lord argued that Homer wrote down what he heard as sung ballads, introducing the vowel letters into the Greek alphabet.[36]

While spoken word can be descriptive and prescriptive in the same manner as written codes, what these sacrifice are the qualities of expression, the intonation, the gestures, pauses and pacing – in short the rhythm – that a good actor gives to the bare text, for instance. The unique performance event of a rhythm with its distinctive micro-variations can be considered as an indicatively a form expression of the bios. In terms of the code it is of course the punctuation marks of written language that serve as reminders of its spoken origins, specifically that most indicative sign of a living being – our breathing. As well as rhythm, linguistic forms and structures such as rhyme recall the oral mimetic devices that writing displaced. If rhythm is symmetrical patterning in time as Georg Simmel tells us, then rhyme is symmetry in sound.[37] Prosodic performance locates rhythm in the arena of *musicking* – the shared social capacious range of activities required for music making – as distinct from the object of the musical code of the score.[38] While the score *pre*-scribes the instruction recipe, as it were, for the musician to produce the each musical note, the data-harvesting algorithm *de*-scribes the life as its played click by click, "like" by "like," often together with its biometric functioning. The score maybe a component of musicking, but musicking is never a component of the score. Indeed Gary Tomlinson argues for the vital importance of musicking in the *homo sapiens'* prehistory as the common grounding for the emergence for not only speech, but also thought and sociality.[39]

Against acknowledging the value and values of prosodic variation and rhythm as distinct from mechanically precise metre, it might be pointed out this is exactly what drum-machines produce – as has been the foundation of Techno and Dancehall music since the 1980s, for instance. Currently, after decades of computer code-generated sound, the tide

is flowing in the opposite direction in favour of live performance, acoustic instruments, analogue synthesisers and vinyl. This can be taken as recognition of analogue values in a digital world, as Damon Krukowski explores.[40] Such reactions against the culture of the algorithm and machine learning would aim to reverse the dominance, suppression and colonization of the kind that written cultures have historically subjected oral cultures.

While recognising the continuities between the qualities of rhythm and the quantities of algorithm a distinction can be made as between timbre and logic, the former a matter of performance, the latter one of mathematical calculation. The subtleties of tone, overtone and texture that give the timbre of a sound is distinctive qualities are experienced as such, even though the Fourier Transform can reduce every frequency to simple sine wave.[41] To emphasise the importance of the qualities timbre a formula rather different to Kowalski's diagram can be configured for rhythm (Figure 2). Here timbre is the complex of frequencies and amplitudes of which every natural occurring sound consists. The periodicity is the frequency of the rhythm, counted in BPM (beats per minute). Rhythm is the pattern or gestalt of periodicity. In this manner timbre could be considered as the logic of the sound, periodicity as its control. The difference between logic and timbre is that between code and performance, or utterance and language is articulated in terms of a huge power differential, as discussed below.

$$\text{Rhythm} = \text{Timbre (Hz + dB)} + \text{Periodicity}$$

Figure 2 The components of rhythm

The role of rhythm in understanding the relationship between spoken and written language also provides a basis for understanding the momentous scale and significance of the current shift from the Gutenberg Galaxy to the algorithmic universe. What speech, text and algorithms have in common is that they take place along a time line. Speech is a performance event in time; text is linear sequence; algorithms are recursive. But this is also where the difference between a line of text and a line of code emerges – speed. Though machine-learning algorithms require training, algorithmic processing time, as with algo trading, is virtually instantaneous. Thus through the acceleration of rhythmic period provides an escape velocity from liner time. This has been characterised by Vilém Flusser as what he calls "the crisis of linearity," that is, the shift from alphanumeric linear coding to

what he calls non-linear "dot interval thinking... expressed clearly for the first time in computers… the machines spit out numbers automatically, in a quantity that deposes of all linearity."[42] Flusser continues his argument: "Algorithms formed islands within texts made from letters. For a while now, mathematical, calculating thought has been breaking out from within the alphanumerical code, is claiming independence, and it is turning against linear thought, to analyze it…"[43] This power that the algorithm holds over non-digital communication is in several respect parallel to that that the written holds over oral cultures. In the way text removed certain embodied forms of expression from speech, so the algorithm now removes what remains of them from text.

Power and responsibility

The issues of corporate power and responsibility are precisely those raised by Helen Knowles' video artwork *The Trail of the Superdebthunterbot*.[47] The 45 min video was filmed in Southwark Crown Court and cast from legal experts (Figure 3). 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 3 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 is tied to 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. It was of course the autonomy of the signifier by which structuralism, as mentioned above, secured its status as the *science* of language, allowing the social sciences at long last to become such. In this 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."[48] 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

The algorithm can in principle be considered as no more than a mechanization procedure, informational automation, redistributing calculation processes to a machine part of the human-machine amalgam. 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 is 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 algorithmic routines 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.[49]

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.[50] 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 vehicle assembly line.[51] The march of mechanisation is hardly novel, as Siegfried Gideon documents in his *Mechanization Takes Command*.[52] In fact these forebodings were brilliantly articulated by Charles Babbage in his prophetic *Ninth Bridgewater Treatise* of 1838.[53]

Algorithmic processing accelerates rhythmic recursion by digital means. As with machine learning, the whole point of code is its manipulation without reference to content or meaning, once the encoding, quantization and quantification has taken place. The algorithm is entirely a behaviourist tool, acknowledging only the difference between input and out, or in classical terms, stimulus and response, as Antoinette Rouvroy has dubbed it "data behaviourism."[66] Not only is the algorithm itself an unknowable Behaviourist black box, on account its autonomous learning mentioned above, but also "for algorithms, people are black boxes that can only be understood in terms of their reactions to stimuli."[67] Currently it is only too evident that the ever-increasing intensities of data extraction operate entirely on the basis of encoded indices of meaning, rather than having any "understanding" as such. After the demise of Behaviorism it was cybernetic engineering that pioneered new models for scientific reductionism. For cybernetics communication and control are one and the same, as Felix Stalder discusses.[70] From this Shannon and Weaver's Information Theory was born as a theory of communication as *engineering* that never concerns content – only code, information, probabilities and signal to noise ratios

etc.[71] There were few dissenting voices for what rapidly became the new orthodoxy. George MacKay and Gregory Bateson were two critics at the time in the 1950s, another more, recently is James Durham Peters.[72] Otherwise human scientists, now speaking the language of structuralism, abandoned the field communication to the information theorists. As Yuval Noah Harari succinctly describes the project of Modernism: "humans agree to give up meaning in exchange for power."[73]

City Rhythms

It is against this background of reductionism that rhythm came to play an important role, most famously with Henri Lefebvre's rhythmanalysis. 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.[74] This comes in the form of a recent study *City Rhythm: Logbook of an Exploration* by Caroline Nevejan, Pinar Sefkatli and Scott Cunningham (Figure 3).[76] The study was commissioned by the Amsterdam municipality for the purposes of civic planning. The authors treat rhythm as a tool for understanding and developing social cohesion and trust. As they state:

> When sharing rhythm, people feel more at ease with each other. Such rhythms can be mundane for example in activities we do every day: bring the kinds to school, walking the dog… These rhythms are at the heart of sustaining everyday life and shaping trust… *City Rhythm* aims to contribute to integrating… [the] paradigms of human experience for participatatory, open, and high trust societies by focusing on rhythm.[77]

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.

Figure 3 *City Rhythm: Logbook of an Exploration*

The authors conclude optimistically that "rhythm analysis, in the physical world as in the related data domain, offer a potential new approach for policymaking.'[78] 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.[79]

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."[80] 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, to which we now turn.

In contrast to Amsterdam's *Rhythm City*, the Google Urbanism project has very different aims and objectives, that would be at the opposite end of the high trust – low trust spectrum that *Rhythm City* identify, where they associate the former with participation, the later with surveillance (Figure 4). Nevertheless, Google Urbanism deploys exactly similar algorithmic data harvesting techniques to render our very presence in urban *public space* as a site for data extraction. The Google website asks: "Why 'presence' in public spaces should generate financial returns for the city, and how Google can help…"[81] This marks an extension of the data harvesting terrain further to that furnished our computer and mobile on-line platforms and the "life interfaces" of Amazon Echo and Google Home domestic listening devices.[82] The comparison of these two projects illustrates the heritage that algorithm has in rhythm. It is simply not the case that rhythmanalysis can be considered as a dynamic and inherently progressive tool and algorithmic processes as its evil twin. Each has a common root in recursive routines of which rhythm is just one example. Rhythm is not in itself not inherently progressive as some researchers – myself among them – might once have hoped. Nevertheless what rhythmanalysis reveals about the nature of human social relationships, such as the importance of trust, might the basis for the kind of critique algorithm analysis aims to provide.

Figure 4 Google Urbanism project

The Google Urbanism project is the brainchild of a group of final year students at the Strelka Institute in Moscow. It provides a telling indication of the corporation's "Speculative Expansion Strategy for Google in Physical Space."[83] An interview with one of the project team Nicolay Boyadjiev together with Denisse Vega de Santiago and Leonardo Dellanoce from the architecture journal *Archis* provides some insight into the thinking at the core of the project.[84] 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."[85] 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.[86] 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.

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*.[91] 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 are not restricted to the racial prejudices of search engines and social media.[92] 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.[93] 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.[94] 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.[95] 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.[96]

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'."[97] 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.[98]

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."[99] 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."[100] The algorithmic analysis software assigning automated "harm scores" to those on the Matrix was developed not by third party, but Metropolitan Police themselves.[101] As might be expected the net effect of algorithmic race profiling techniques has be been to dramatic increase the impact of policing on certain demographics. This was confirmed in a recent substantial report from Stopwatch that found that "Black people were stopped and searched at more than eight times the rate of white people in 2016/17."[102] This kind of evidence makes it impossible to argue that algorithmic techniques do nothing but reflect the values of the society that produced them.

Pattern analysis

A further common feature of rhythm, rhythmanalysis and algorithmic protocols is that all three 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. The key feature of pattern analysis is that it is intended to be predictive, as already described with the Police Gangs Matrix. Thus the human scale of the time line of rhythm is ruptured not only by the non-human speed of algorithmic processing, but also even more significantly, by the claim that the only certain knowledge of human affairs is restricted to events in the past. This takes us into what previously has only been a science fictional

world of the pre-cogs in the film *Minority Report*. There are instances where the predictions offered by AI and machine learning can be utilised by those with benign intensions, notwithstanding data privacy issues. Brent, Bristol and Thurrock are among the local authorities using such techniques to predict children at abuse risk, or gang risk to children, for example.[103] In the hands of the military, of course, this is not the case, as discussed below.

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 that is linear, or polyrhythms in parallel.[104]

As well as auditory, such patterning can also be visual in space as with a gestalt. Essentially patterning emerges from the relationship between things, rather the things themselves. Our human perceptual faculties limit such groupings, unlike those learnt by machines. In the 1950s cognitive psychologist George Miller famously identified human short-term memory capacity as being 7 individual objects + or – 2.[105] 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."[106] This is to say patterning relies on relationships of difference. This critical insight has been most eloquently expressed by Gregory Bateson when he states, "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*."[107] 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 generate patterns, both rhythmanalysis and algorithmic procedures are designed to detect and extract them, the later from the terabytes of big data. 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. Rhythmic inflection has origins in the periodic motion of human activities practices and techniques. This might appear to set it apart from algorithmic procedures, whose periodicity would be assumed to be grounded in mathematical codes. Indeed mathematics has traditionally prided 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, language has to be considered as evolving from embodied gesture.[109] In short, mind and hand co-evolved. More recently Brian Rotman applies a similar argument specifically to the language of mathematics itself.[110] 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. This tends to dissolve what might first appear a difference between rhythm as deployed in rhythmanalysis, and rhythm as it is utilized in algorithmic routines.

The Kill Chain

The journey rhythm makes from music to speech to written text to algorithm finds expression in the military application of algorithmic calculation, the final most extreme example. Rhythm that started out a sign of life is transformed literally into sign of death. Historically armies have an interest in rhythm with marching bands and drills to march in step.[117] 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 (Figure 6). As Grégoire Chamayou describes this patterning is already being made us of – by the military, in terms of activity-based intelligence (ABI).[118] 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."[119]

In this way "*activity becomes an alternative to identity*."[120] 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."[121] "Signature strikes" as they are called, rely on these patterns of behaviour rather than a known named target as such.[122] Gregory refers to such patterns of life explicitly as a "militarized rhythmanalysis." [123] 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.[124]

Figure 6 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.[125]

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*.[126] 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."[127] 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.[128]

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.*[129]

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 (Figure 7). 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."[130] 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.[131]

This also congruent with Bourdieu's conception of habitus that describes the dynamics and dispositions.[132]

Figure 7 Military Pattern of Life

Like rhythmanalysis, Pattern of Life analysis is concerned with extrinsic relationships, that is behaviours, rather than objects.[133] 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.[134]

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," thus affecting what could be called a moral anaesthetic as to their consequences.[136] 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.[137]

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."[138] 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.[139]

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.[140] 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.*[141] To whatever 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. The values that rhythmanalysis uses rhythm to attempt to capture from social life are in fact precisely those excluded from the ways in which algorithmic procedures extract value from the data sets. Rhythm remains a common thread through the historical progression from oral to written and, as argued here, from written to algorithmic codes, turning from elixir, to predictor, to exterminator of life. Thus rhythm's analysis is revealing of the hugely significant changes currently underway.

Figures

Figure 1 Kowalski's components of an algorithm, diagram

Figure 2 The components of rhythm

Figure 3 Courtroom sketch by Liza Brett to document Helen Knowles' video work *The Trial of the Superdebthunterbot* (2015)

Figure 4 *City Rhythm: Logbook of an Exploration*

Figure 5 Google Urbanism project

Figure 6 ABI diagram

Figure 7 Pattern of Life analysis as used by the military

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