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THE EMERGING POST-ANTHROPOCENE

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All Watched Over By Machines Of Loving Grace

I like to think (and
the sooner the better!)
of a cybernetic meadow
where mammals and computers
live together in mutually
programming harmony
like pure water
touching clear sky.

I like to think
(right now please!)
of a cybernetic forest
filled with pines and electronics
where deer stroll peacefully
past computers
as if they were flowers
with spinning blossoms.

I like to think
(it has to be!)
of a cybernetic ecology
where we are free of our labors
and joined back to nature,
returned to our mammal
brothers and sisters,
and all watched over
by machines of loving grace.

Richard Brautigan[1]

In 1967, the American novelist and poet Richard Brautigan wrote 'All Watched Over by Machines of Loving Grace', a visionary poem that paints a picture of a future world in which nature, humankind, and cybernetic technology live together in harmonious coexistence. In Brautigan's vision, these machines of loving grace are computer systems that are fully integrated into our earth's natural systems, thereby creating a cybernetic ecologic techno-natural metasystem. This all-providing system leaves humankind free to pursue its innate desires without the burden of labour and anxiety for survival.

When looking through these '60s San Fransisco-styled rose tinted glasses, the lineage to the present-day Silicon Valley induced rhetoric of trans-humanist Singularitarians is apparent. This techno-utopian vision has been passed down by the Whole Earth generation, and has slowly been absorbed into the broader cultural imagination, while along the way planting the seeds for its eventual realisation. A healthy dose of scepticism is indispensable in this regard, however, in recent years possible pathways towards the emergence of a global cybernetic ecology have become visible.

Technologies such as RFID, Bluetooth LE, and WiFi-Direct have enabled the development of devices that can be easily connected to larger planetary-wide cloud networks, ushering

1 Brautigan 1967.

075

in the era of the Internet of Things. By embedding sensors and computing technology in almost anything, from our home appliances, to live stock, and from globally shipped containers, to our cars and architecture, we are creating a networked smart-grid that collects data from innumerable sources and can actively respond to that data in real time. Noted futurist and sci-fi author Bruce Sterling sees this deployment of 'ubiquitous computing' as a one of the 'historic-scale ways to become cybernetically sustainable.'[2] Modern cities with their high concentration of networked devices, such as smart phones and IP cameras, are particularly well-equipped breeding grounds. Sterling observes that 'it's hard to imagine cities being denied a role in the sustainable and the cybernetic.'[3]

Media theorist Benjamin Bratton, borrowing a term from IT that describes a set of software and hardware that supplies the infrastructure for computing, has appropriately dubbed this planetary-scale system of computation we are fostering 'The Stack'. According to Bratton, we should not see 'the various species of contemporary computational technologies as so many different genres of machines, spinning out on their own', but 'instead see them as forming the body of an accidental megastructure.'[4] This megastucture is, as of yet, not evenly distributed, to paraphrase Gibson, but in our cities and transportation hubs its presence is palpable. Bratton defines six distinct layers in the Stack (Earth, Cloud, City, Address, Interface, and User) and proposes that 'the content of any one layer […] could be replaced (including the masochistic hysterical fiction of the individual User […]), while the rest of the layers remain a viable armature for global infrastructure.'[5] Arguably, we have already intentionally commenced on our trajectory to replace the 'User layer' quite some time ago.

076

Unknowable Intelligence

Since its inception in the 1950s, artificial intelligence has held great promise, and in the early days researchers in the field, such as Mavin Minsky, were confident that they would be able to create a true artificial intelligence within a few decades. However, after an initial spurt in the 1960s research activity died down, and apart from some very specific non-general applications for AI little progress was made during the following decades. Except for when the chess computer Deep Blue defeated world champion Garry Kasparov, in 1997, interest in the application and implication of artificial intelligence stayed mostly within the confines of computer science and sci-fi discourse. However, in recent years breakthroughs in specific fields of AI research have made headlines worldwide.

In 2011, when IBM's Watson was able to win a modified game of Jeopardy! against two former human winners, it signalled a big step forward in natural language processing, the process of extracting meaning from written words. Even though the DeepQA system that powers Watson may not be an actual thinking machine, it did demonstrate that its bio-inspired brain-emulating parallel computing framework is capable of processing massive amounts of data quickly and accurately.[6] What's more significant though, is that Watson showed that it was capable of learning on its own. Through its taxonomical and ontological processing, hypothesising, and evaluating abilities, it learned how to play Jeopardy! strategically. As journalist James Barrat describes in his analysis of Watson, after it 'got a correct answer in a category, it gained confidence (and played more boldly) because it realised it was interpreting the category correctly. It adapted to game play, or learned how to play better, while the game was in progress.'[7] The ability of a computing system to self-improve is a potentially disruptive notion given the increasing availability of computing power and the vast amount of data generated by sensor networks and human input on a daily basis.

076

Currently, the most striking examples of self-improving computer systems come from the field of machine learning, more specifically, the successes that have been booked with the advancements made in artificial neural networks. In 2014, Google acquired the start-up DeepMind that had created a remarkably successful self-learning system by combining artificial neural networks with reinforcement learning.[8] Both of these technologies are in essence cybernetic feedback systems that are inspired by biology. Artificial neural networks take inspiration from how our brain is structured and reinforcement learning mimics how organisms react to different stimuli. What is extraordinary about these approaches to machine learning is that the knowledge

2 Mulder 2010: 344.
3 Mulder 2010: 345.
4 Bratton 2014.
5 Ibidem.
6 Barrat 2013: 219-220.
7 Barrat 2013: 221.
8 Simonite 2014.

076 **112-113 • Breeder is a software application that provides its users the ability to playfully explore the principle of artificial evolution. The software is based on the 'Biomorph' program as proposed by the British evolutionary biologist Richard Dawkins in his book *The Blind Watchmaker*. Variables like the colors, patterns, and movement of abstract visual elements are encoded into an artificial DNA. The user can crossbreed and mutate the genetic codes of these elements, thus creating new generations. This leads to an endless stream of rhythmically pulsating images that highlight the poetic beauty of the evolutionary process.**

representation or 'intelligence' emerges from them without being explicitly implemented. Deep learning AIs are trained on large datasets of information, how they exactly make sense of this data inside of the neural network is often not clear, not even to the people who trained them. These are bottom-up approaches to giving a computer system the ability to self-improve by providing it with ample amounts of examples to learn from. Consequently, AI researchers have been baffled by some of the results that these systems have produced.[9]

DeepMind's first claim to fame came in December 2013 when it presented its software at a major machine learning conference. There, the company demonstrated how their system was able to play the Atari games Pong, Breakout, and Enduro better than any expert human player could. Leading AI researcher Stuart Russell recounted that 'people were a bit shocked because they didn't expect that we would be able to that at this stage of the technology […] I think it gave a lot of people pause.'[10] After being acquired by Google, DeepMind made international headlines in March 2016 by beating Lee Sedol, the world's top Go player of the last decade, in a five-game match, a task previously thought impossible for current-day AIs to achieve. The AlphaGo program that was used to play the Go matches was trained using DeepMind's deep learning technology and surprised its human opponent and supervisors with certain strategies it took that no human player would ever consider.[11] After the top-down approach of Deep Blue, and the parallel hypothesis generation and evaluation approach of DeepQA, the bottom-up up approach to implement AI championed by DeepMind, is quickly becoming one of the most successful method to develop new AI implementations.

While many of the noteworthy successes of AI have been when it was used to play games against human opponents, its real-world applications reach much further. Watson is currently used for medical diagnosing and deep learning algorithms are being developed to solve problems in numerous areas such as facial recognition, image search, real-time threat detection, analytics for finance and business purposes, voice recognition, motion detection, sentiment analysis, etc. A specific example is the current boom in research around driverless cars, which is in part propelled by the application of machine vision powered by neural networks. Both IBM and Google make computer chips based on newly developed architectures that are specifically designed to improve computing with neural networks.[12 13]

This trend toward using self-learning and self-improving AIs sets us up for a dramatic set of circumstances. If we look at the bigger picture and see the application of artificial intelligence in relation to the rapid development of our planetary-scale computation stack, we can see how the data-producing systems we are creating on the one hand are increasingly being used in conjunction with the intelligence creating systems on the other hand. We are already giving our AIs access to the information produced by the sensor networks around our houses, in our cities, and on our farms. They are the Siris and Cortantas running on the servers connected to our mobile devices. They will be shuttling us around once driverless cars take over. Our drones fly on autopilot. Low latency algorithmic trading has fundamentally changed the way stock market works. Smart-grids powered by renewable energy sources are being implemented across the globe. The cloud layer of worldwide server networks that store all our data, all our knowledge, are being maintained with the aid of AIs. Clearly, we are deeply invested in this future.

The Post-Anthropocene

The implication of this is that we are starting to rely on systems of which we do not understand exactly how they do what they do and know what they know. Inventor and computer scientist Danny Hillis has labelled this new frontier that we are moving into 'The Age of Entanglement.' According to Hillis, 'Our technology has gotten so complex that we no longer can understand it or fully control it. […] Each expert knows a piece of the puzzle, but the big picture is too big to comprehend.'[14] Complexity scientist Samuel Arbesman states in agreement that we 'are in a new era, one in which we are building systems that can't be grasped in their totality or held in the mind

9 Ibidem.
10 Simonite 2014.
11 Silver and Hassabis 2016.
12 Jouppi 2016.
13 IBM 2016.
14 Arbesman 2016: 35-36.

of a single person; they are simply too complex.'[15] Arbesman anticipates that soon we will need to approach our own systems like we approach natural systems. We will 'need interpreters of what's going on in these systems, a bit like TV meteorologists' since 'we can't actually control the weather or understand it in all its nonlinear details', but 'we can predict it reasonably well, adapt to it, and even prepare for it'.[16] [17] In the near future humankind will once again be surrendered to a world over which we have little control. However, this time it will not only be nature that escapes our grasp, but we will live in 'a world where nearly self-contained technological ecosystems operate outside of human knowledge and understanding.'[18]

This sentiment is not necessarily new; versions of it have been around for over two decades. For instance, in 1997, scientific historian George B. Dyson already noted that 'we have mapped, tamed, and dismembered the physical wilderness of our earth. But, at the same time, we have created a digital wilderness whose evolution may embody a collective wisdom greater than our own. […] We have traded one jungle for another.'[19] And, in 1999, N. Katherine Hayles in her discussion of the post-human declared that 'if the name of the game is processing information, it is only a matter of time until intelligent machines replace us as our evolutionary heirs.'[20] However, they were both arguing around the concepts of an artificial life form equipped with trans-human super intelligence that would succeed humans as the dominant intelligence on earth. In contrast, the planetary-scale computing system that we see emerging at the moment does not necessarily imply such a super intelligence, but rather points in the direction of a different kind of consciousness, a machine intelligence, or cybernetic ecology.

Even though we are just coming to terms with the fact that we have brought the earth into the Anthropocene, arguably, we might have to readjust that notion already within some decades considering that we as humans will not be the ones at the helm of spaceship earth anymore. The complex systems that we create and the algorithms that run them -the global cybernetic feedback networks of sensors, machines, and intelligences- are what is going to determine the future of our planet. The post-Anthropocene is emerging, it will be of our own making, and it may be here sooner then we expect. As Benjamin Bratton has observed: 'One of the integral accidents of the Stack may be an anthrocidal trauma that shifts us from a design career as the authors of the Anthropocene, to the role of supporting actors in the arrival of the post-Anthropocene.'[21] He also cogently mentions that 'The aporia of the post-Anthropocene is not answered by the provocation of its naming, and this is its strength over alternatives that identify too soon what exactly must be gained or lost by our passage off the ledge.'[22]

What the post-Anthropocene will look like is hard to predict, there are so many factors to consider, the complexity of the technology involved is increasing exponentially, and our discourse around the subject is only beginning to substantialise.[23] Hopefully, our collective efforts will not lead us towards a major catastrophe that will indirectly be the auto-termination of our species, but instead towards the utopian vision of a cybernetic ecology that Brautigan had, in which machines of loving grace do actually watch over us.[24]

15 Arbesman 2016: 19.
16 Arbesman 236.
17 Arbesman 2016: 179.
18 Arbesman 2016: 10.
19 Dyson 1997: 228.
20 Hayles 1999: 243.
21 Bratton 2014.
22 Bratton 2013.
23 An important technology that I've intentionally left out of this discussion is genetic engineering. The rapid advancements in technologies for gene sequencing, editing, and synthesising and the projected applicability of these technologies are indicative of the extreme significance genetic engineering will play in the future of the human race. The impact of genetically modified humans can hardly be understated and if the lofty goal of the end of ageing can be achieved the concept of what it means to be human will forever be changed. This in and of itself could be a form of post-Anthropocentic existence and thus would necessitate further investigation, but for the sake of conciseness I decided to keep this topic out of my analysis.
24 Barrat 2013: 229.

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