**SLEEP
CURES
SLEEPINESS**

For a major part of mankind's history, time was not tracked and kept, but searched for and observed. It was understood by the pace of cyclic events and rhythms of bodies, crops, stars and solstices. When still measured by sundials, the length of hours changed throughout the year with the different inclination of Earth's orbit around the Sun.

But with the increasing miniaturisation and mobilisation of time-keeping devices, time entered our bodies with the calculated precision of a laser cutter, letting in valorisation of heartbeats. Metabolism got worked around and natural cycles were either ignored or 'genetically modified'. Time got flattened in a fashion pioneered by machines operating seamlessly around the clock and with speeds beyond human comprehension.

For this publication, contributors were invited to share notes on the gap that resists the unification of body rhythms, dreams and spontaneity with the tempo of machines, communication networks and calculable profit. Here is a song for the flesh under the attack of constant availability and no place to hide, information overload, omnipresent context advertising and fear of missing out.

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DO ANDROIDS DREAM OF SLEEPING?

Angela Mitropoulos

What do machines think about having to work all of the time? Pascal, the seventeenth-century mathematician, invented the roulette wheel while trying to build a perpetual motion machine, or so the story goes. Whether that story is entirely accurate or not, it remains a deeply apocryphal one. The figure of the scientist whose experiments yield accidental inventions is as usual in the less-than-determined history of science as speculation has been the general result of the quest for continuous motion. Put more specifically, one of the long-standing obstacles to the creation of robots imbued with artificial intelligence – that is, machines capable of complex interactions, learning, problem-solving and adaptability – has been the absence of an effective formulation of irreversible time in physics. Mathematical formulations of time have for the most part been reversible – they can go forwards as well as backwards – because they are not actually about time so much as they are calculations about matter dancing around in space. Much like, as it happens, a white ball spinning around a wheel divided into red and black pockets numbered from 1 to 36.

Indeed, physics did not grapple with any discernible concept of time before the mechanical became motorised, energetic. This, perhaps, is the revenge of the not-so-servile cyborg lurking in the shadows of Marx's thermodynamic dictum that 'class struggle is the motor of history.' Before large-scale industrialisation and Carnot's hypothetical heat engine in the nineteenth century, physics was mostly content to comprehend time through motion, gravitational forces, mass, acceleration, inertia. Yet, simultaneously troubled by the problem of entropy and spurred on by the quest for automation and robotics, physicists began to approximate a concept of irreversible time by elaborating the statistical distributions of unknown trajectories. The Boltzmann machine is the most notable instance of a stochastic, generative network; but it remains a theoretical rather than practical leap toward complex, adaptive machines because it runs into problems of saturation without restriction. It breaks down because of too much 'noise,' too much data. Algorithmic formulations in computer science have

Dashboard

He kept cool.
He kept waiting.
He kept answering whatever incoming.
This was the train he was taking.
He kept cool.
Kept waiting.
But then he asked himself: How long have I been here?
Technically speaking, he knew in splits of milliseconds.
127265.3589865632170
Yet this gave him no real sense of the duration.

Meanwhile, more and more people piled in, to stick around and get nervous. The platform started swelling with discomfort of strangers getting too close to each other. Producing heat and smells that Mathis remembered from Sarah's under-pit.

Flies began to look for a better shelter.
He kept waiting.

The only thing he could focus on was the second hand of his wristwatch that his father used to wear and wind. Second-by-second pacing within the inner rim. Its circular shape, the colour of a nostalgic prank.

As already mentioned, he didn't need it to check the hour. His internal nano-clock told him with delicate precision. Synchronised —with all the unison timekeepers of every living body— in a sort of telepathy, gained by seamless-ness, he managed to loose track of time.

delivered greater complexity in the form of syntactical operations. Yet the concept of time in physics remains, at best, an idea of relative, emergent or derivative phenomena. The most complex formulation that physicists have come up with is that matter and time are 'entangled.'

And so, in the more recent history of physics, we arrive at the theories of quantum mechanics, far-from equilibrium

conditions of dissipative structures, and so on; which is to say: the pronounced acknowledgement of foundational incertitude, molecular restlessness, volatility.

The point of this brief excursion into the history of physics is to underline the non-existence of a uniform measure of time, and a suggestive irony. The implication of the above is not simply that physicists have been encouraged by practical considerations to capture stochastic processes in mathematical formulations, albeit with parametric restrictions or some version of renormalisation that stops short of genuine random processes. Not only have they admitted the foundational indeterminacy of time into calculations of time, and therefore accepted that these times in which we live are neither eternal nor universalisable. More suggestively perhaps, they have proposed that the technical condition for the creation of complex, adaptable machines that can learn and solve difficult problems is not continuous motion but, instead, 'paradoxical' or REM sleep, dreaming. As Foulks *et al* put it, 'the best way to equilibrate the energetic needs of the robot and ensure survival is to use the nightly rest to reorganize the pieces of data acquired during the daily learning, and to trash the less useful ones.' Sleep is, in other words, induced so as to avoid the noise saturation problem encountered by the Boltzmann machine. It is also posited as an efficiency solution to the problem of scale: 'the same circuits can be used for both daily learning and nightly forgetting and thus costs are lower.'¹ Much of this is premised on neurophysiological hypotheses about the role of dreaming in memory, in remembering and forgetting. The development of algorithmic approximations of human brain cells during 'paradoxical' or REM sleep is a consequence of the institutional development of cross-disciplinary platforms involving

neurophysiology and computer science, as much as it is the result of the invention of instruments that image and measure the brain, which has prompted an obsession with the brain as the locus of explanation and experiment. Before this, the mapping of the human genome similarly elevated genetics. Centuries ago, it was the heart. In that sense, none of this amounts to a case for the renewal of faith in science

Have you heard of The International Dark Sky Association?

or technology. Far from it.

What is significant here is the extent to which the search for intelligent machines has, due to the practical failures that have beset other approaches, increasingly involved experiments with machines capable of sleeping, and dreaming. Physicists such as Pascal and Prigogine are interesting because, in privileging the experimental and therefore the practical, both were obliged to derive determinism from uncertainty. Chaos theory, as discussed by Prigogine and Stengers, is inclined to discern the order that arises from disorder, albeit one that is far from equilibrium and emergent. In the *Pensées*, Pascal had argued that 'it is not certain that all is uncertain' by contrasting the affective impact of the relative continuity of (awake) time with the unaffected but relentless discontinuity of dreams ('all dreams are different'). There is, however, recurrence in dreams. But more importantly and against Pascal and Prigogine, irreversible time – the trajectory of the 'arrow of time' – remains uncertain, indeterminate, incalculable in the singular case.

Which raises the underlying question about systems rather than specific machines. The way in which limits or parameters are set against such uncertainty, as much in conjectures about intelligent machines as in the accounting control systems of corporate firms, is by way of a question about the allocation of risk. In experiments on the development of intelligent machines, including that conducted by Foulk *et al* noted above, costs remain internal to the hypotheses and formulations. In all these experiments, machines are assumed to be the property of the firm, and that all of the costs will be borne by their owners. The attempt to minimise costs translates into the development of machines that can sleep. By contrast, the accounting systems of firms are oriented toward

the externalisation of ‘negative’ costs. Put simply, uncertainty is displaced – workers assume the costs of their own health, bad risks such as environmental degradation are relegated to outside the firm, the impact of private profit is socialised, and so on. That is, the absence of any uniform measure of time is, in practice, supplanted by the generalisation of an accounting system that has, at its centre, a device that allocates risk and uncertainty. This is the contract. The appeal of machines, or of automation, from the perspective of firms and employers has long been regarded as their inability to sign, negotiate contracts. The delineation of labour from any association with machines, or the human from machine, has been an important part of the history of the labour movement. And yet, it may well be in the persistent failure of the expectation to become more like an intelligent machine capable of working continuously, one increasingly accompanied by the plausible simulation of emotion as well as agreement afforded by the contract, that the significant fault-line of the system might be found. This is the strategy of becoming-machine – disaffection or ‘going into robot’ (as Arlie Hochschild notes of the tactics of overworked flight attendants) discussed elsewhere.²

In the burgeoning field of sleep and performance research, the development of biometric technologies that can quantify the fatigue of truck drivers, among other things, highlights the limits of contractual displacement through risk management strategies on the part of firms. It is also a reminder that the accidental remains a feature of the irreversibility of time. It is the accidental that drives innovations in systems of control and risk management, but all such innovations fail because the trajectory of the irreversible singular – the Lucretian *clinamen* – will always elude prediction and pre-emption. So, then, what do machines think about having to work all of the time? The crucial term in this question is not, as it might have first seemed, ‘machine,’ ‘think,’ or ‘work’. It is the inconstancy and inconsistency of ‘time’ that conditions all these other concepts. The system tends toward failure – that is, at most a pseudo-equilibrium – precisely because there is no effective or uniform way in which to measure irreversible time.

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Notes

- 1 J.D. Fouks et al. *Do robots need to sleep?* Clinical Neurophysiology, 34:2, 2004. pp. 59-70.
- 2 Angela Mitropoulos. *Uncanny Robots and Affective Labour in the Oikonomia*. Cultural Studies Review, 18:1, 2012. pp. 167.

Sarah's manager called. Making mechanical sounds through her teeth, she counted every step into his office, where the same music was always on repeat. Hey Sara, you know. There is smiling and smiling...