Robot Makes Free

The Leibnizian cryptowar of Norbert Wiener

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> The world of the future will … not [be] a comfortable hammock in which we can lie down to be waited upon by our robot slaves.
>
> — Norbert Wiener, *God and Golem,* Inc.

The word 'robot' entered the English language just over a hundred years ago, on 9 October 1922. It arrived with a Broadway production of the play in which it was coined, *Rossum's Universal Robots* (*R.U.R.*) by Czech writer Karel Čapek, which immediately captured the *Zeitgeist* and was being performed in theatres around the world as quickly as it could be translated.[1] Though the conceptual drama and its author may have been lost to popular memories (beyond Central Europe at least), the spectre of its neologism – *robot* – which in the play signifies a 'race' of artificial humans who turn against their creators, haunts the world ever more with each milestone that today's revolutions in 'machine learning' bring. This begs a question: beyond science fiction and beyond techno-utopias – what is signified by the concept of a robot?

An ontological other out for your bread, a failed simularum of authentic existence – fembots, Chinese, autists – and the cyborgs that we anyway all are.[2] These are the three employments of 'robot' (always undefined) I found in the archive of a certain magazine that has existed for half its life, namely *RP*, yet none get at the concrete sense of power there originally and in its richest philosophical discussion since: the cybernetics of Norbert Wiener. This article shall discuss each in turn. Alas the concept of the robot has emptied out and lightened up. Perhaps this has something to do with the fact that the other side of Paulo Virno's observation that one thing an AI cannot fake is having a 'good sense of humour' is that, in at least a certain popular unconscious, the robot has become the paradigmatic *object* of humour:[3] a classically Bergsonian being of mechanical inelasticity in movement, voice and intellect where one expects the pliableness of a living being.[4] Think *L'uomo meccanico*, the Tin Man, Robby the Robot, C-3PO, the Roomba vacuum cleaner, etc.

The original play had no such slapstick. It is true that Čapek did consider the play 'a comedy, partly of science, partly of truth', and that his characters represent rigid archetypes expressed univocally by their names – Dr Rossum, the inventor of the robot, from the Czech for intelligence (*rozum*), Busman represents businessmen, Domin from Latin *dominus* and 'robot' from a root meaning drudgery, forced labourer, orphan or slave – the German *Arbeit* shares the same root. But as Ivan Klíma shows, Čapek intended their one-dimensionality to imitate the 'simple, calm, direct classical farce' of Plautus' comedy *The Brothers Menaechim*, wherein each 'character is assigned from the outset a single interest … no turning points, no changes, no psychological development at all.' The joke is in the irreversibility of humanity's self-destruction, of some 'terrible machinery [that] must not stop, for if it does it would destroy the lives of thousands. It must, on the contrary, go on faster and faster'.[5] It is the worker's soul which is slowing this machinery down, the dross of their 'feelings of altruism and camaraderie, all familial, poetic, and transcendental feelings'. For to the boss:

> Everything must be speeded up … The workers' question is holding us back. The worker must become a machine, so that he can simply rotate like a wheel. Every thought is insubordination! … A worker's soul is not a machine, therefore it must be removed. This is my system … I have sterilized the worker, purified him.[6]

These words actually preempt *R.U.R.* by nearly a decade, hailing from the short story 'The System' (1911) which Karel Čapek co-authored with his brother Josef, who would later suggest the word 'robot' to name *R.U.R.*'s soul-stripped – hence purely machine – workers. Likewise, *R. U. R.*'s 'robots' are just artificial humans lacking a natural sense of humanity, sterile and pure workers produced en masse by the play's eponymous corporation. Yet between these two texts, between 1911 and 1920, a noticeable gear has shifted in Čapek's writings. The violence is of another order – World War I has taken place. The System has *actually* tried to strip the soul from the worker. Millions who might otherwise have been part of an international class struggle have been reduced to killing machines, butchering one another on an industrial scale for the narrow and conflicting interests of their rulers. The system in question, which was clearly capitalism, is now more general. *R.U.R.* implicates not only capitalism and the State but, as a comedy of science and truth, also a certain potential of humanity as such.

In Čapek's play the R.U.R. Corporation manufactures artificial humans who have no desire, no will to speak of: fleshy – chemical and biological, not mechanical – but cattle-like 'living machines' who the corporation brags can be fed 'on pineapples, straw, whatever you like.' The best of these 'robots' work relentlessly for twenty years before being 'used up', in which time they have been two-and-a-half times more productive than a naturally-born human. By radically undercutting the price of labour, orders are placed by corporations and governments for such soulless 'shadows of man' by the hundreds of thousands until they replace human labour altogether. A (purportedly) rare number of these robots suffer an episode of 'teeth gnashing', whose obscenity – a hint at a soul? – means they get sent immediately to the 'stamping mill' for termination. They go indifferently. Though the General Manager of R.U.R. nurtures a Fully Automated Luxury Communist ambition[7] to turn 'the whole of mankind into an aristocracy nourished by millions of mechanical slaves', the birth rate of humanity crashes to nil since it has no work to sustain itself, and its armed uprisings are stamped out by impossible robot armies bought by governments to protect their economies.

It has been argued by Louis Chude-Sokei that *R.U.R.* represents a late imperial anxiety of slave rebellions in the vein of Mary Shelley's colonially-minded *Frankenstein*.[8] Yet were Čapek to have wanted White audiences to identify with the naturally-born humans of the play who end up wiped out by the robots' genocidal war of liberation, he would have surely depicted them as morally superior to their slaves-turned-exterminators. Instead *R.U.R.* presents natural humans as liable to becoming *equally* servile to the interests of capital as its artificial ones. Human statecraft as secure in the pockets of blinkered corporate agendas. Human shareholders as hell bent on the 'dream of dividends, and their dividends are the ruin of mankind'. The robot's justification for eventually murdering all natural humans is not entirely unfounded, all things considered: 'Slaughter and domination are necessary if you would be human beings. Read history.' I take Čapek's point to be that you don't need to be born in a factory – or of a certain race – to be a robot, you just need to turn in your soul and rotate like a wheel. The natural humans who represent the interests of capital and state are no less 'robots' than the robots themselves. This is to say that in its origin the robot is *not* the fiction of a fascist imagination, but the fiction of fascists imagined: a premonition seen in WWI by two brothers who would come to lead Czechoslovakia's cultural resistance to Fascism until their demise under its shadow: Josef, who coined the word 'robot', perishing in the concentration camp system whose gates bore those terrible – yet poignant – words, '*Arbeit Macht Frei*'.

Machine, machine, machine

If *R.U.R.*'s robots are vaunted as products of 'modern engineering' but hail from the technical imaginary of an era when the Ford assembly line was barely seven years old, today they should be reconsidered in light of the technoscientific revolution that has since taken place. Cybernetics. The 'information revolution' or, in Einstein's words, the 'information bomb' which exploded into history during the following World War but whose consequences are only starting to be felt.[9]

No less a figure than the father of cybernetics – MIT physicist Norbert Wiener – delivered a prologue to the MIT drama society's performance of *R.U.R.* on 5 May 1950, the thirtieth anniversary of the original. Wiener's book *Cybernetics, or Communication and Control in the Animal and the Machine* (1948; 1961) had only just introduced the public to the logical and programmable computer,

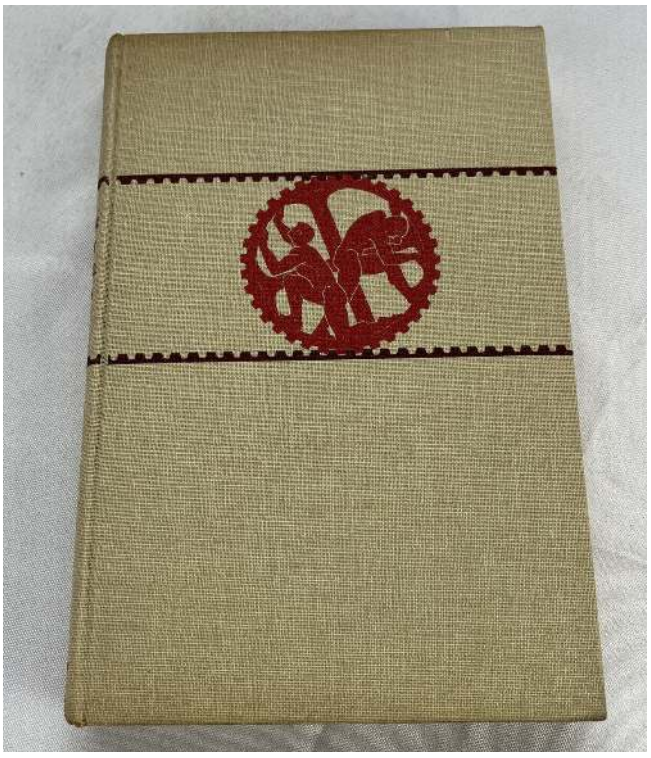
to information as a statistical quanta inverse to entropy, to the analogy of homeostasis in the organism and negative feedback in a machine, to the possible simulation of nervous systems, to a universal ontology of things defined by their communication and self-regulation. It concluded with a chapter that touched on the social and political consequences of this revolution, an argument drawn out in the sequel *The Human Use of Human Beings: Cybernetics and Society*, whose first edition (*HUHB*a) was to be published imminently to wild critical and commercial success. Though there is no mention of Čapek or robots in either *Cybernetics* or *HUHB*, both books develop a theory of a 'new Fascism' rendered possible, inevitable even, by cybernetic machines, a theory that is carried to its conclusion in Wiener's final book, *God and Golem,* Inc. (1964).[10] The cover of the first edition of *HUHB*a depicts two figures merged inside a rotating pinion, a circular gear – immanent to it and supplying its force. This is unlike the Tramp in Chaplin's *Modern Times* who gets trapped *between* gears and thereby within a system he in fact transcends, but exactly as the Brothers Čapek put it in 'The System', the worker having become a machine which 'simply rotate[s] like a wheel'. Wiener uses his *Prelude to* R.U.R. to introduce his socio-political argument, which begins by distinguishing Čapek's robot from the cybernetic robot and its philosophy:

> When the play was written, the automatic machine was still in its infancy, or perhaps it is even better to say was still in its gestation. Since then, we have had not merely a succession of automatic machines, but a philosophy of automatic machinery itself.[11]

The following article will discuss what such a 'philosophy of automatic machinery' – a cybernetic philosophy of robots – entails.

Functioning automatic

In truth, except for in that early paper and his *Prelude to* R.U.R. Wiener hardly uses the word 'robot'. Perhaps because of his education in philosophy – he read Plato in Greek as a child, philosophy for his PhD under Josiah Royce and George Santayana, and sat in lectures by William James, Bertrand Russel and Edmund Husserl – he uses a classical term far richer in philosophical significance with roots in Aristotle: 'automatic machine'. In his *Prologue for* R.U.R. Wiener clearly aligns robots and automatic machines by claiming that Čapek wrote his play while 'the automatic machine was still in its infancy, or perhaps it is even better to say was still in its gestation.' Wiener swaps out Čapek's robot for what may seem a quaint phrase – automatic machine – but in doing so only increases its intensity.



If 'automatic machine' sounds quaint we can at least in part thank the marketing departments of so many car and arms dealers who have glibly replaced 'automatic' with 'autonomous'. Wiener was consistent in avoiding such a collocation, employing autonomy sparingly and never affirmatively as an attribute of machines.[12] For him, the robot is not *auto-nomos*, subject of its own laws, rather it is precisely that which has to have laws prescribed to it by another, which has no autonomy to speak of. His use instead of 'automatic' for machines accords to the classical tradition of an accidental cause whose end may seem to be intrinsic but is in fact entirely auxiliary. The motor cause in all such cases is *automaton*, quite literally *auto-matên*, 'by itself in vain', an accident caused by a pure motor cause.[13] Aristotle distinguishes *automaton* ('chance', according to its conventional translation) from *tuchê* ('fortune') as an accidental cause that has involved an incidental element deliberation, for example someone who decides to take a stroll and, as fortune would have it, bumps into someone who owes them money. To Aristotle the capacity for decision-making sets one animal, the hu-

man, above all others as a political animal, as that whose nature affords a life that need not be confined to mindless automatism; or *should* not be so, for the very flourishing of life is at stake in the activity of training oneself – and one's citizens, for a government – to act evermore virtuously. (*Nicomachaen Ethics*, 1103a21-1103b6.) An automatic machine is *a priori* a being which moves but without a capacity to choose its own ends.

Wiener presses this Aristotelian point in his *Prelude to* R.U.R.. Referring to the opening scene of *R.U.R.* where orders are received for robots by the tens-of-thousand – a Fordist model of mass-production – Wiener notes that the coming aeroplane factory would need 'two dozen Mark 18 assembly-line robots' alone: plus one human: a 'taping expert' to 'tell the machine what it has to do'. The automatic machines Wiener describes may be able to build aircraft but they are not autonomous, they need someone to programme them, to decide their *telos finalis*. A few robots may be able to build fleets of aeroplanes, but they are still the puppets of a programmer. The engineer governs the automatic machines.

Automatic joy

Wiener followed in the tradition of those who build automata in the image of nature. Switching on his flashlight and yelling 'Here, Palomilla!', a motorised buggy drove onstage. Palomilla could steer towards his torch (Moth-mode) or away from it (Bedbug), behaviours determined by a feedback loop involving photosensitive cells on either side of her neck. She was a hoot – *The Harvard Crimson* reported that Palomilla drove into the stage curtain repeatedly and acted with 'at least as much decision and far more speed than an earthworm'.[14] Sensitive to her comicality, Wiener beckoned the audience to consider not 'the particular facial resemblance of this machine to a living organism' – to laugh with Bergson at the one who with mechanical rigidity imitates the fluidity of the living – but its 'soul, and what it does and how it behaves'. The soul of Palomilla was its attempted replication of an inner behaviour essential to organic life, not a superficial appearance.

Principally, the machine was not actually meant to represent a moth or bedbug at all.[15] Rather, by continuously correcting its orientation to balance the intensity of light upon its two photocells it was to model the vital principle discovered by Claude Bernard which would be named 'homeostasis' by the Harvard physiologist Walter Cannon, whose protégé Arturo Rosenblueth would diagnose the overshooting of Wiener's groundbreaking WWII aircraft flight predicting machine as akin to a hand doomed to swing past its object due to cerebellar damage, or a resting hand's Parkinson's shake – both, failures of compensation, debts paid too much or too little.[16] The engineering vocabulary for such self-regulation and overcompensation in machines had already been established by Bell Labs in the 1920s with respect to amplifiers – 'negative' and 'positive feedback', the former since unwanted signals are progressively removed from an output before it is fed back in again as an input, the latter since they are left to accumulate – think of the screech from a loudspeaker when a microphone inputs the speaker's output back into itself over and over.[17] The immediate invention of the collaboration between the physicist Wiener and the physiologist Rosenblueth, together with engineer Julian Bigelow, was a new homology of machine and organisms based on the identification of homeostasis and negative feedback, intention tremors with positive feedback.[18] Palomilla's superficially-comedic indecision, her bouncing into walls, represent both kinds of physiomachinic pathology; her demonstration during Wiener's *Prelude to* R.U.R. being one of the very first public demonstrations of the new age of cybernetic automatic machinery which we see everywhere today.

That the essence or 'soul' of a mechanical automata may appear homologous to the mechanism of an organism involves a second philosophical signification – an aesthetico-cognitive sense – latent within some of the earliest discussions of automata in Greek thought. Wiener seems to touch on this in *Cybernetics* when he writes,

> At every stage of technique since Daedalus or Hero of Alexandria, the ability of the artificer to produce a working simulacrum of a living organism has always intrigued people. This desire to produce and to study automata has always been expressed in terms of the living technique of the age.[19]

That the makers of automata have always drawn 'intrigue', as Wiener says, echoes Hero of Alexandria's own depiction at the start of his opus *On Automata* (approx. 50-100CE) that people consider the makers of automata, ' "wonder-workers [*thaûmatourgous*]" because of

the astounding character of the spectacle.'[20] Certainly the automata of the Hellenic world's foremost engineer were wonderful spectacles in a quotidian sense: one involved a mechanical Dionysus walking about with a fennel staff that spurted out milk while he poured libations of wine to dancing Bacchantes and the thunder of falling lead balls.[21] However, to follow Francesco Grillo, there is also a philosophical sense to the 'wonder' that Hero inspired with his automata.[22] This wonder goes beyond that which Aristotle argues is at the root of our enjoyment of 'automatic marionettes' (and philosophy too) early in the *Metaphysics* (983a11-15 and 982b12-21): the aporetic wonder of being dumbfounded by a mechanism's operation which leads to trying to figure it out. Wonder in this sense is the servant of knowledge. Elsewhere, Aristotle offers another explanation whereby the pair are equals: the delight in an imitation of nature itself, man's being 'the most imitative creature in the world', and through the appreciation of a work which imitates nature, a pleasure which 'is one at the same time learning' and is available universally even to the non-philosopher (*Poetics*, 1448b6-20). Aristotle adds that the source of the pleasure of such mimesis is not in the sensible charms of the organism copied, nor the skill of the artisan who copies them, but in the understanding itself of the 'original realities' and 'links of causation' that the mimic representation proffers (*Parts of Animals*, 645a7-15). The 'intrigue' that Wiener refers to as having always been drawn by the makers of automata from the production of the 'working simulacrum of a living organism' derives from the appreciation of the automata's mimesis of nature and the intricacy of the mechanisms at stake.

Today, it would be impossible to feel the wonder that Hero describes about his own automata. They were powered by counterweights of flowing mustard seed and millet.[23] The same goes for the clockwork automata envisaged by Leibniz and his contemporaries, from Thomas Boyle who insisted on a univocal explanation of corpuscles and the inner workings of a clock, to Descartes who held no doubt that 'when swallows come in spring, they operate like clocks. The actions of honeybees are of the same nature', to Hobbes' animals composed of 'springs and wheels as doth a watch'.[24] The aesthetico-cognitive pleasure of automata as such may be transhistorical, but the possibility of its effect is historically determined, and consecutively so.

To every age, a distinct 'living technique', Wiener argues, one defined by an archetypical machine – an 'operative image'[25] – whose 'soul' acquires the status of an essential foundation upon which all knowledge of nature stands. He divides the modern era into three such ages: an age of clocks, one of thermodynamic engines and an age of cybernetic machines (specifically, I would argue, the internet).[26] Through cybernetics, Wiener claims to resolve the inadequacies in the thermodynamic operative image. How so?

Full of negentropy

Wiener attributes the prime enunciation of the thermodynamic operative image to Erwin Schrödinger's famous 1944 depiction of life as that which, through metabolism, 'delays the decay into thermodynamical equilibrium (death)'.[27] Some read Schrödinger's thermodynamic negative entropy (later contracted as 'negentropy') as contemporary to cybernetics. This is a misunderstanding. For the sake of clarity and to see how Wiener replaces Schrödinger's image with a cybernetic one, it is worth recapping the modalities and stakes of the problem of entropy in thermodynamics.

The conventional illustration of this begins with a box of billiard balls. Same size, shape, weight and hardness, different colours. On the left of the box white balls are stacked, on the right, black. At this point there is a *disequilibrium* in the dispersion of colours. The box has an *order* to it. It is a state that you are unlikely to find in the universe; its natural occurrence would be highly *improbable*. Now, if you shake the box, soon the balls will be evenly jumbled. No more separation of colours, a *disordered* grey mass like the static of an analogue TV, an *equilibrium* of colours. This is the most *probable* state in the universe. If you did want to see their original ordered disequilibrium again you better be prepared to keep shaking indefinitely.

Now replace shaking balls with a real thermodynamic system. An isolated chamber of atoms, hot and fast ones on the left, cool and slow on the right. The difference in temperature can be exploited to do things, to work – the system is an ordered disequilibrium. Given some time, the atoms would mix themselves up throughout the chamber just like the shaken box of balls. How wrong the ancient atomists were to hold that like attracts like!

The total energy of the system would remain the same, since according to the first law of thermodynamics (the principle of conservation of energy) the amount of energy in the universe can neither increase or decrease, but its conversion back into an ordered and usable energy would be exceptionally unlikely (second law of thermodynamics). It energy has not been destroyed but wasted, dissipated, subject to 'disgregation' or 'entropy'. This is the tendency of everything in the universe, the thermodynamic arrow of time points to a deathly equilibrium of all things, the lifeless 'heat death of the universe'.

Why then is there not only something, but constant regeneration and life? Schrödinger answers that life is that which feeds upon external sources of energy, like a chamber whose entropy naturally increases unless a load of atoms of a different temperature are injected in. Organisms to him are defined by their consuming the universe, metabolising things that hold a calorific value and converting them into waste. Foodstuffs constitute, according to him, 'negative entropy', since they reduce the entropy of the organism and so push back its death; their spent form which the organism emits he calls 'positive entropy'. The operative image here is clear: organisms are thermodynamic engines whose life consists in burning fuel.

Wiener picks out a flaw in this in his critique of biophysicist Nicolas Rashevsky, but I would argue the glove was made to fit Schrödinger.[28] If the very ruling principle of the thermodynamic operative image is the energy's conservation and degradation of energy into heat, then why, for the same amount of work, Wiener presses, do engines burn so hot while organisms keep so relatively cool? Where is all the radiation and heat from their work?

Wiener anticipates that Schrödinger might reply that there is an essential difference between the chemical energy of an organism and that of an engine. If the analogy can even survive such a distinction, then how can it account for the analogy of brain and nervous system? Wiener rebukes: Are we to construe the organism as outputting thought 'in the form of energy, as the muscle puts out its activity'?[29] The precise wording Wiener employs suggests that he may have had in mind an attack on phrenology by the nineteenth-century American anatomist Thomas Sewall, who lambasted the phrenological analogy of brain and muscle which lead its adherents to believe that, like a large muscle, the bigger the brain the greater its power.[30] Wiener's point is that energetic power is an inappropriate measure of the capacities of a brain and as such these mechanists of the 'age of steam engines' can no more than the clockwork-minded Cartesians account for the 'coupling' of body and mind.

Against Schrödinger Wiener instead offers a new op-

Photos of *R.U.R.* from the Theatre Guild production at the Garrick and Frazee Theatres, New York, 1922/23. Scans by Tobias Higbie.

erative image for an 'age of communication and control': the brain *qua* computer – and not only because of their analogous capacities for logical reasoning, of the realisation of Leibniz's *Machina Ratiocinatrix* in the Turing machine.[31] Instead, by emphasising the parallels of the brain and just-invented digital computer's low energy consumption, Wiener displaces the thermodynamic principle of energy conservation as such. For even if the colossal first digital computers of the 1940s consumed, says Wiener, 'a quantity of energy which may well be measured in kilowatts … the energy spent per individual operation is almost vanishingly small, and does not even begin to form an adequate measure of the performance of the apparatus'.[32] The work of digital computers and brains needs an altogether new scale of measurement. A new value.

Not *energy*. Certainly not the *mechanical force* of the Cartesian age – Wiener: 'the mechanical brain does not secrete thought "as the liver does bile," as the earlier materialists claimed' (another quote seemingly from the anti-Phrenologist Sewall, though it carries an echo of Pierre Jean Georges Cabanis too).[33] No, *information*. The automaton of today can be neither clock nor engine, but cybernetic machine. Hence Wiener's notorious injunction:

> Information is information, not matter or energy.[34]

But what is information? Wiener identifies it with 'negative entropy', using Schrödinger's formulation although in a distinctly unreified sense. Man cannot live *on* negative entropy alone, as to Schrödinger, but one does live *by* negative entropy. Wiener's information as negative entropy depends on an inventive reading of a thought experiment involving the chamber of atoms by James Clerk Maxwell.

Maxwell supposed that entropy could be reversed given an imaginary scenario of a divider inserted into the chamber with a door small enough to fit a single atom, and a doorkeeper or 'pointsman' – William Thomson (Lord Kelvin) nicknamed it the Maxwell Demon – who opened it for hot particles travelling from one side and cold particles from the other. Given such a demon, half of the chamber would gradually fill with hotter particles, the other cooler, and the entropic tendency of the system could be reversed, without the addition of an external source of energy.[35] Maxwell intended his demon to accentuate its own absurdity: such a being or mechanism would be impossible, and even more so following the quantum mechanical discovery, writes Wiener, that the very perception of an atom would increase its energy and change its course.[36] The Maxwell demon is doomed to remain a thought experiment which illustrates the necessity of the degeneration of all systems.

Yet more interesting than jettisoning Maxwell's thought experiment altogether, Wiener says, is to answer the question it poses: How would such a hypothetical demon know to open or close the door in the first place?

The cybernetic answer was revolutionary.[37] Some kind of physical process, radiation say, could be read by a (hypothetical) demon as a channel, a message, from which it could derive knowledge – *information* – about the particle: its position, trajectory and speed. Knowing these, the demon could know when to open and close the door so as to bring about order. The quantity of information the demon has about the particles directly corresponds to its capacity to reverse the entropy of the chamber. Information hence measures the statistical possibility of the negation of entropy – a probability since the second law of thermodynamics does not exactly assert the impossibility of heat returning to energy, but the extreme improbability of its so doing. If entropy constitutes the extent to which a condition is stable, probable, disordered, homogeneous and dead, then information measures its instability, improbability, order, difference and life.[38]

Wiener could now subsume Schrödinger's depiction of life as negative entropy, but do so in a radically original way. It is a thing's capacity for *information* which determines the extent to which it is alive. Organisms live not merely because their environment provides them with energy which they consume like an engine, but more fundamentally because they adapt themselves to their environment by drawing adequate information from it. The essential quality of life is not metabolism, but homeostasis. Wiener stresses that the energy the demon receives from the world, the particle's radiation, is 'far less significant than the transfer of information'.[39] In this way he resolves the problem of why brains and computers are so unlike engines in that their output far exceeds their energy input. Energy is an inappropriate measurement of the work of nervous systems and computers. Instead, the age of cybernetic machines is premised on *information*.

We might note that this is why apologists for the vast energy consumption of computationally-expensive processes such as cryptocurrency mining and machine learning frequently retort that energy cannot be used to value the work of such processes, only information can. Their fallacy lies in a failure to consider whether their so-called 'information' will ever be able to reverse the heat death of the system named Earth that their computations are contributing to, and if not whether it is actually no more than a perhaps beautiful mode of entropy, like a glimmer of petrol on the surface of a stream. This is the junction at which cybernetics came to peel off especially in the 1960s into those who 'went off into computers' and 'input-output', as Margaret Mead and Gregory Bateson describe computer science, and ecologists like themselves who recognised Wiener's cybernetics to be 'the science of the whole circuit.'[40] Unfortunately, many ecologists came to mirror the mistakes of such 'computer scientists' by rejecting the conceptual value of information to ecology outright.

Dancing mechanic

The discovery of the statistical concept of information as negative entropy allows Wiener to formulate a new 'operational image' and 'working simulacra of a living organism', or what Heidegger calls the 'fundamental science' of the age.[41] To live is to possess a greater degree of information than the entropic forces of death about. Yet Heidegger failed to appreciate the philosophical foundations that Wiener had laid, framing cybernetics as sovereign of just the positive sciences. Instead his cybernetics should be read as a system of thought in the vein of Leibniz's monadology, to which it can be read as a reply. Today this much is becoming increasingly acknowledged, for one through the work of Yuk Hui,[42] while Wiener's recognition of Leibniz as founding the principles of digital computing continues to be detailed by works such as the recently published collection *Leibniz on Binary: The Invention of Computer Arithmetic*, edited by Lloyd Strickland and Harry R. Lewis (2022).[43] What is not so appreciated is how Wiener's cybernetics not only stands upon but then usurps the *Monadology*, and how information is premised *critically* upon Leibniz's theory of perception, and cybernetic control on its notion of domination.

Wiener bestowed various honorifics upon Leibniz – 'patron saint for cybernetics', 'in more than one way, the intellectual ancestor of the ideas of this book [*The Human Use of Human Beings*]' – but beneath these the critical relation between cybernetics and the monadology surfaces precisely in Wiener's discussion of the Maxwell demon:

> In the long run, the Maxwell demon is itself subject to a random motion corresponding to the temperature of its environment, and, as Leibniz says of some of his monads, it receives a large number of small impressions, until it falls into 'a certain vertigo' and is incapable of clear perceptions. In fact, it ceases to act as a Maxwell demon.[44]

This is a reference to Leibniz's depiction of death as '*un vertige*' in which substances (monads) are unable to distinguish their perceptions, when monads see nothing but 'a vast number of *petites perceptions*' as when 'we continuously spin around the same direction' (*M*21).[45] Wiener reads the Maxwell demon and thereby information directly with respect to Leibniz's infinitesimal notion of perception, and thereon he launches his attack.

Let us briefly summarise what Leibniz's theory of perception entails, since it is key to Wiener's theory of information. In the *Monadology* every substance is a so-called 'monad' which mirrors the entire universe from a singular perspective defined by the relative clarity and confusion of its infinite perceptions. Only the primitive monad of God clearly and distinctly perceives – in Leibniz's language 'apperceives' – every perception. All others are subject to an infinity of perceptions which they know only in the most confused of senses, as well as perhaps a few which they do apperceive. The distinction between mere perceptions and apperceived perceptions (or simply apperceptions) allows Leibniz to posit substances as subject to infinite degrees of perception. This departs from Descartes who held only three: the confused and obscure perception of sensation, the clear and obscure perception of pleasure and pain, and – for human souls – the clear and the distinct perception of the substances (mind, body, God), number, duration and so on.[46] Even the primitive monads of stones will receive an infinity of perceptions, but the higher monads of animals and humans may also distinctly apperceive some. These undulate throughout their life, coming and going, though a human may raise their apperceptive potential, may potentialise itself, through the embrace and study of its divinely chosen world, and moreover through inventing automata: through 'imitating something of [the sys-

tem of the universe] through smaller scale constructions (*échantillons architectoniques*) of their own' and thereby making of itself 'a little divinity of its own sphere' (*M*21). We live and we *live* to the extent that we apperceive.

Hence to suffer an abject lack of apperceptions is a kind of death – as it is for Wiener's Maxwell demon. So-called 'death' to Leibniz is a stupor, dream or a fainting fit from which nothing is remembered. Truly, monads only die if God would decide to annihilate them by miracle; what 'death' *really* is is a descent into a vertiginous coma-like confusion: 'an infinity of little perceptions all at once, in which there is no single one which is clearly distinguished from the others' (*M*21). Life cannot escape death, it emerges out of it to the extent that its apperceptions 'fold' out of its perceptions.

Leibniz's concept of death is the basis upon which Wiener, in the passage above, can depict the Maxwell demon who 'ceases to act as a Maxwell demon' – who dies – as akin to a monad who 'falls into "a certain vertigo" and is incapable of clear perceptions.' Wiener is aligning the entropy of the dead Maxwell's demon with the apperceptionless perceptions of the dead monad, and so vice versa, the information or negative entropy of the living demon with the apperception of the monad. *Information with apperception and entropy with mere perception*. For the cybernetician the informationalising/apperceiving Maxwell demon is more than a thought experiment, it is the living organism as such. In the same way that the monad comes to life when apperceiving, comes to death when it cannot, Wiener carries on to define living beings as 'metastable Maxwell demons', as *beyond* (meta-) the condition of deathly entropic stability.[47] To this Leibnizian Wiener, a being's drawing of information from undifferentiated entropy constitutes its temporary relief of life from death.

Hook up

If the claim that the modern concept of information is based in Leibniz's theory of perception seems bold, consider that Wiener had already demonstrated familiarity with Leibniz's notion in his remarkable (though unremarkably neglected) philosophical entries for the 1918-1920 *Encyclopedia Americana*. An entire entry – 'Apperception' – constitutes an intervention by the young Wiener into the conflation into the single word 'perception' of both the vague and imperfect apprehension of things and the clear and self-conscious apprehension of them – or what Leibniz calls apperception – by the day's Anglo-American psychological orthodoxy.[48] Against them he invokes first Leibniz's theory of perception and then its contemporary psychological inheritors, Johann Wilhelm Wundt, Friedrich Herbart and William James. Much of the entry reads as though about cybernetics: the depiction of how, for Herbart, the incursion of a new idea into the mind 'disturbs the equilibrium', the turn to James' depiction of infant consciousness as 'a big, blooming, buzzing confusion', the formal situation of the monadology as the origin in need of return; but also the stress upon – and departure from – the windowlessness of monads; their being, the young Wiener notes, 'with no reference whatever to the apprehension of external things.' Wiener in his cybernetic writings would emphasise exactly this point too: Leibniz's windowless monads are like, he writes, 'little figures which dance on the top of a music box … [they] have no trace of communication with the outer world, except this one-way stage of communication with the pre-established mechanism of the music box.'[49]

Whereas in the young Wiener's 'Apperception' entry he speaks through the voice of others and leaves moot the consequences of opening the hermetic monad's perception onto an outside world, *Cybernetics* with all its drumming apocalypticism constitutes a profound reflection on what it means for the monad to have windows, on the splitting open of Leibniz's 'true atom'.

Control: one can neither talk seriously about apperception nor information without also appreciating what is entailed by the second verb in the title of Wiener's opus *Cybernetics, or Communication* and Control *in the Animal and the Machine* and how it derives by necessity from Wiener's monstrous adoption of Leibniz's theory of apperception as the foundation of his – our – concept of information.

Recall that for Leibniz the 'Perfect agreement of all, which have no communication with each other, could come only from a common cause': God.[50] Wiener sees this point as pertinent enough to *Cybernetics* to elaborate:

> Each [monad] lives in its own closed universe, with a perfect causal chain from the creation or from minus infinity in time to the indefinitely remote future; but

> closed though they are, they correspond one to the other through the pre-established harmony of God.'[51]

This causal chain from every monad to God cannot be mechanically explained via a transfer of force or energy from one to the next, since monads do not interact with one another. Rather they possess an internal principle of change, an 'appetite', which consists in a striving from one perception that God has pre-inscribed in them to another. Their perceptions are internal, their causes *intra*-substantive, not inter (*M*7). How is it then possible for a monad to seem as though it acts upon another? Leibniz's answer is that the links of a 'golden chain' that make monads seem as though they determine one another are their relative explanatory capacities, their relative degree of apperception with respect to one another.

This chain is organised in a pyramid. Since to Leibniz apperception involves clarity about the divine wisdom instilled in every aspect of the universe, the golden chain involves a hierarchy of monads which, ascending from so many coma-like vertigo-suffering bare monads to the primitive monad of God who perfectly apperceives everything, can ever more clearly explain why something is as it is, or better, why it is so so as to contribute to God's plan for the best of possible worlds. The hierarchy of the universe is ordered according to the capacity of all substances to decipher (apperceive) God's infinitely detailed cryptogram. In this sense we can say that the monad of the mind can be said to cause the monads of the fingers and toes to swim in the sea because, although the digits merely perceive the infinite ripples and contours of the water, the mind has a greater degree of clear and distinct perceptions (a more active appetite) than the confused and relatively passive digits, and it can thereby offer a better explanation than them. The toes in turn can better explain the perceptions of the monads of its hairs, and so on. A monad's greater degree of apperception relative to another constitutes its *domination* over it. As Leibniz says, 'considered in terms of the monads themselves, domination and subordination consist only in degrees of perception.'[52]

Leibniz's taxonomy is a cascading pyramid of determination in its triple sense of knowledge, power and will, with the primitive monad of God at its apex, the bare monads of minerals and plants at its base with animals above them, and human souls organised in between. This is not only a pyramid of knowledge, but also inalienably domination and subordination. *Of power*. But of course, only by analogy since Leibniz's windowless monads cannot, in fact, inter-communicate with or control one another.

What happens when the older Wiener retains Leibniz's logic of apperception but plugs photocells into the

monads, such that the *analogy* of communication with others is rendered *actual*? When windows are punched into the monad, and its apperceptions involve others? What are the consequences of all this for the cybernetic automatic machine and its world?

Playing yourself

Wiener offers a certain kind of structure as an answer, with a set of rules, which is to say a kind of a game, but this is neither the structure of the structuralists nor the game of game theory. Critiquing his contemporaries, it is something of his own.

Wiener's critique of Structuralism is targeted at Benoît Mandelbrot and Roman Jakobson, the former having copy-edited the original *Cybernetics* manuscript and the latter having collaborated with Wiener on a stochastical study of phonemes in Russian after inheriting a Professorship in Slavic languages at Harvard in 1949,[53] a post established for Wiener's eminent father Leo Wiener who held it for the greater part of half-a-century.

In an addition to the second edition of *The Human Use of Human Beings*, published in 1954, Wiener reflects that Mandelbrot and Jakobson,

> consider communication to be a game played in partnership by the speaker and the listener against the forces of confusion, represented by the ordinary difficulties of communication.[54]

He explains this with recourse to an argument which he attributes to Mandelbrot, which itself draws from Shannon's work on the optimum redundancy of letters in 'A Mathematical Theory of Communication' (1948). Through computational analysis, Mandelbrot, he writes, shows how natural languages tend towards an optimal distribution of word lengths, which implies that they have over time undergone a process of natural selection. This is, as opposed to artificial languages like Esperanto where no such optimal distribution of word lengths is to be found. Wiener writes that this natural 'attrition of language', a phylogenetic homeostasis of words, implies that languages evolve towards a sort of 'optimum form of distribution' through the processes of guarding against confusion. The words in languages naturally evolve towards states ever richer in information.

This being the case, Wiener argues, the 'philosophical assumption' of Mandelbrot's 'ordinary' and 'normal' linguistic game theory is that the 'major opponent of the conversant is the entropic tendency of nature itself'. The structuralist deployment of information treats languages as though the actual speakers who constitute them are no more than nature passively awaiting an adequate linguist. The structuralists play a game against the universal tendency of nature to deteriorate into entropy.

What right does Wiener have to depict these structural linguists as game theorists? For one thing because, while Wiener was revising *HUHB* Mandelbrot himself was doing so. In 'An informational theory of the statistical structure of languages' (1953) Mandelbrot writes of the 'association of language to a game', specifically with the famous game of Ferdinand de Saussure's *Course in General Linguistics* in mind: chess.[55] He invokes Saussure's depiction of chess as being, 'like an artificial realization of what language offers in a natural form' – an argument supported by three premises.[56] First, the state of the board at any one moment corresponds to the state of a language. Second, both language and chess depend on unchangeable conventions which pre-exist and persist through every game and conversation. Finally, a single move can 'revolutionize the whole game'. Thereby Saussure introduces his signature distinction between conventional 'diachronic' linguistics, which concerns the past and future 'evolutionary phase' and 'historical grammar' of a language, and his own 'synchronic' linguistics, which concerns the present arrangement of language-states. In structural linguistics as in chess, Saussure argues, it only matters what happened ten-moves prior in as much as this diachronic fact led to the current synchronic state of the game.

Central to Wiener's critique of Mandelbrot and Jakobson's structural cybernetics is Saussure's admission that his analogy between language and chess has one weakness – the need to imagine in language an 'unconscious or unintelligent player' who makes their moves like the player in chess.[57] The players of the structuralist game are relegated to external diachronic forces as much as the previous moves are just historical events. They are not exactly irrelevant, since 'a language can only be compared to the idea of the game of chess taken as a whole, including both [synchronic] positions and [diachronic] moves',[58] but external forces and past moves come under a lesser class of analysis. The actual game of a chess game for Saussure has little to do with the two players;

it resides in the analyst's reading of the current field of play. Lévi-Strauss puts this fact succinctly in *The Story of Lynx* (1991) when he answers the question of who the opponent of the structuralist anthropologist is: 'We play against myths'.[59] The opponent of the structuralist game is no more the natural entropy of ignorance, and while '[ignorance] plays a difficult game', Wiener writes, 'he may be defeated by our intelligence as thoroughly as by a sprinkle of holy water.'[60]

In the *Human Use of Human Beings* Wiener names the opponent of structural analysis an 'Augustinian evil': natural entropy, mere ignorance, epistemological lack, where 'the black of the world is negative and is the mere absence of white'.[61] He identifies it with Einstein's formulation, 'God may be subtle, but he isn't plain mean'; and it is the evil of Leibniz's theodicy, the good deriving from apperception of God's creation, evil ignorance thereof.[62] In truth Wiener formerly saw himself as battling the same enemy, as evidenced by a letter he wrote in August 1933 with an eye to events in Europe:

> Knowledge is a good which is above usefulness, and ignorance an evil, and we have enlisted as good soldiers in the army whose enemy is ignorance and whose watchword is Truth. … This is of course the point of view of the German liberal scholar of the middle of the last century … All modern professional scholarship is the heir of that Germany.[63]

For Wiener (if perhaps not many of his followers) this calling would not survive the coming war wherein he would be enlisted to develop an apparatus that could shoot down Nazi aeroplanes, the evil of bombs pouring from the sky; an *enemy bomber* whose possible future points of interception are not only subject to the entropy of uncertainty, given the mores, the character, of their aircraft's signature flying pattern, but whose pilot's cunning evasive manoeuvres strive to confuse their enemy's attempts to decipher a targetable position. The opponent here is very much not nature. It is an enemy who actively resists. Who encrypts their signature and attacks their enemy's capacity to forcefully decrypt it through disinformative behaviour. The dance of the enemy aircraft and anti-aircraft battery does not just involve coding and decoding, as per Mandelbrot and Jakobson's playerless structural cybernetics, but of enciphering, disinformation and cryptanalysis (surveillance). Not the darkness of entropy as the lack of informational light but, as Wiener puts it, 'white and black belong to two opposed armies drawn up in line facing one another.'[64] Communication as conflict between enemies who 'bluff' and employ 'jamming forces in order to adapt themselves to new communication techniques', enemies who actively seek to plunge each other into confusion.[65]

A game of six halves

At stake is not merely information or communication theory, but cryptology: a martial paradigm which construes its enemy to be, Wiener says, a 'Manichean evil'. Modern cryptology is the study both of *cryptography*, which concerns the techniques of mathematically encrypting and decrypting messages (cryptograms) between friends so as to be unintelligible to enemies, and *cryptanalysis*, the techniques of forcefully breaking open the cryptograms of an enemy so as to strengthen one's position, as well as its inverse *disinformation* ('pseudography'?), the meta-technique of distributing false-messages and false-cryptograms into the enemy's internal communications so as to divide their very coherence and even their very ability to distinguish friend from foe, rendering them a weaker player. This final side is why, according to Chelsea Manning in a recent *FT* interview, 'The Russians are spending way more on spreading disinformation [in Ukraine] than on trying to obtain secrets.'[66] By contrast information theory only involves an encoding and decoding which does not take the friend-enemy distinction into account, and therefore 'the political' which is established on this distinction (Carl Schmitt). Whereas the Augustinian paradigm of information theory conceives the passive darkness of ignorance to be its opponent, the Manichean involves an enemy who actively resists, a real opponent in a struggle for domination within a cryptological field of battle.

In war, diplomacy, politics, law, business – in the war-diplomacy-politics-law-business of actually constituted science – the negation of entropy of one is the amplification of entropy of another. The greater the surveillance into the bomber's imminent position, of the cryptoanlysed information, the greater the control over it, the closer it draws to death. In such conflict the light of one is the darkness of another; the Manichaean struggle is a zero-sum-game.

Wiener's critique of the apolitical game theory of the

structuralists leads to his critique of Game Theory proper, John von Neumann and Oskar Morgenstern's simultaneously nascent science. In *HUHB* he broaches this via Claude Shannon[67] – but not the Shannon of 'A Mathematical Theory of Communication' (1948), the sun around which information theorists tend to revolve. Rather instead the Shannon of 'Communication Theory of Secrecy Systems' (1945 but classified until 1949), a product of his wartime work mathematically proving the security of Roosevelt and Churchill's encrypted telephone line.[68] In this paper, which lays the foundations of modern cryptology as a statistical discipline and forms the basis of his 1948 theory of information, Shannon explicitly depicts the situation between cipher designer (cryptographer) and cipher breaker (cryptanalyst) as a game which accords with that of von Neumann and Morgenstern's theory of strategic games, one played between mutual-'enemies'.[69] In turn, the founders of Game Theory had depicted the fundamental questions essential to all games of strategy as being in a more abstract sense essentially cryptological too:

> How does each player plan his course, i.e. how does one formulate an exact concept of a strategy? What information is available to each player at every stage of the game? What is the role of a player being informed about the other player's strategy? About the entire theory of the game?[70]

Von Neumann and Morgenstern's Game Theory is cryptological in that it involves a contest between players over each other's information. Not merely the synchronic arrangement of chess pieces but of each other's plans and diachronic future moves: not for the sake of intellectual curiosity but to predict, outmanoeuvre and beat them. Stabilised in the grave, *pax perpetua*. Critiques abound of the rational self-interested subjectivity assumed by conventional Game Theory – Wiener's is internal to his philosophical system. 'Naturally', Wiener writes, 'von Neumann's picture of the player as a completely intelligent, completely ruthless person is an abstraction and a perversion of the facts.'[71]

His argument is that given that the struggle for life *over one another* is determined by a zero-sum cryptological struggle over information, it should not be assumed that all players have equal capacities for play, equal knowledge from which to extrapolate one another's moves: 'It is rare to find a large number of thoroughly clever and unprincipled persons playing a game together.' Instead an exponential disequilibrium of capacities should be assumed, one that skews control to the information rich with respect to the information poor. Wiener calls the former knaves, the latter fools:

> Where the knaves assemble, there will always be fools; and where the fools are present in sufficient numbers, they offer a more profitable object of exploitation for the knaves. … [T]he fool operates in a manner which, by and large, is as predictable as the struggles of a rat in a maze.[72]

Since predictability is aligned with entropy in Wiener's information theory, the fool is closer to disorganisation and death. The knave is their opposite: so organised, unpredictable and alive to the fool that their moves increasingly stupefy. Adam Curtis' *Hypernormalisation* (2016) portrays such a knave in Vladislav Surkov, whose ideological and practical support of Putin's regime entailed his 'play with and undermin[ing of the Russian people's] very perception of the world, so they are never sure of what is really happening … [A] strategy of power which keeps any opposition constantly confused. A ceaseless shapeshift[ing] that is unstoppable because it is indefinable.'[73] Von Neumann and Morgenstern's Game Theory presumes their players to be stable equals: the subjects of Wiener's cybernetic game theory are locked into rendering one another more or less capable players. Given that there is an infinite quantity of information to be accumulated, that according to Wiener's system 'no man is either all fool or all knave', the best one can say is that the game is always open to be played, however skewed against the information poor it may become, however much their opportunity for control tends towards zero.

Shoshana Zuboff's notion of 'surveillance capitalism' touches on this dynamic while putting the cart before the horse.[74] Any economic system would have to contend with the potential for an accumulation of information and imbalance of capabilities the cybernetic game of control involves. The surveillance that she dwells on is only one type of move in a game which also involves encoding, decoding, encryption, decryption and disinformation. Both surveillance and disinformation imply each other as violent acts against an enemy whose goal is the relative gain of control, the former an accumulation through theft, the latter a diminishing through poison. To dwell solely on surveillance, as Zuboff does, is to solve

one of six sides of a Rubik's Cube, and to focus only on capitalism is to play for one row. The relative degree of power is what is at stake, not just the accumulation of secrets, which is why Wiener's critique leads him to foresee it giving rise to not only a new kind of capitalism but a new kind of Fascism as well as its concomitant subjectivity, the automatic machine.

Machine à gouverner

Clearly we are no longer in the land of Leibniz's Best of Possible Worlds.

When Wiener renders actual Leibniz's analogy of the intercommunication of substances, when he shows that due to the emergence of the cybernetic operative image the beings who waltz upon the music box do so by actually apperceiving one another not by acting out an infinitely-detailed script that a benevolent God has authored in them at the beginning of time, Wiener replaces Leibniz's pyramidal preestablished harmony of all beings with, to use André Robinet's phrase, a 'tangle of interconnected myriagons'.[75] Not a horizontal plane à la Hardt and Negri but an infinity of pyramids in every direction. To reinterpret cybernetician Warren McCulloch's neologism which is currently enjoying a moment of vogue, a 'heterarchy' not a hierarchy, one in which, as Bruno Latour puts it, any 'harmony is postestablished locally'.[76] If in Leibniz each monad only acts *as if* it apperceives the other, but truly acts out a script chosen by God for its role in the play, The Best of Possible Worlds, the older Wiener realises that if monads *actually* apperceive one another, the single God-pinched hierarchy is smashed to an infinity of hierarchies, and with this not only divine authorship but all sense of benevolence in the universe too. Instead of seeming to dominate one another in a single great pyramid, these actual intercommunicating beings actually do so. The game for Leibniz is in the Augustinian deciphering of the infinitely detailed pyramid; for Wiener it is a total, Manichean, cryptological state of conflict – what may be called a 'cryptowar'.[77]

Wiener declares the horizon to which the Manichean cybernetic age tends a '*machine à gouverner*', taking the phrase from Dominique Dubarle, a Dominican theologian whose *Le Monde* review of *Cybernetics* he uncharacteristically reproduces across three pages of *The Human Use of Human Beings*.[78] Dubarle defines the *machine à gouverner* – Wiener leaves it untranslated – as a 'State apparatus covering all systems of political decisions'. This is a machine with 'enormous privileges' which will render 'the State as the best-informed player at each particular level'; being so advantaged in the six sides of the cryptowar that it will 'permit the State under all circumstances to beat every player of a human game other than itself by offering this dilemma: either immediate ruin, or planned cooperation.' It constitutes no less than a 'A great World State' and 'a world worse than hell for every clear mind' – no less than the rise of a 'prodigious Leviathan' compared to which that of Hobbes was 'a pleasant joke.'[79] Wiener and Dubarle envision the great cryptological machines of our day: of the Five Eyes, China, Russia, Israel and so on, each of which is shrouded in a secrecy which only admits meaningful competition from state cryptological players or their servants, or from internal leakers to which the cryptological friend/enemy distinction will be applied, especially to those at the bottom (Edward Snowden) but also at the top (Hillary Clinton's server).

Simondonians take note! What is it that Dubarle says the *machine à gouverner* gathers its information about and strives to control, abstractly? None other than – in his own words – '*les réalitée humaines*'. The cybernetic Leviathan's awesome power over humans is derived from its being a Maxwell's demon of human realities as such. In this sense we can say that the reality of humans is distinct from the *machine à gouverner*, since they relate through competition and are not on the same side. Yet this very exteriority, this capacity to think the relations of conflict involving a 'colossal state machine … [which is] quite possibly being planned by a secret military project for the purposes of combat and domination', writes Wiener in 1950,[80] is what Simondon considers a problem. He denounces the separation of human and machinic realities as expressions of a 'primitive xenophobia', 'facile humanism' and a 'system of defence against techniques'. *Les réalitée humaine* is essential to *les réalitée technique*! To deny this is to be alienated from the essential technicity of life; to impose 'purely mythical and imaginery' relations of competition and domination between humans and machines. To render 'machines in the service of man' is to reduce them to slaves argus Simondon, 'in the belief that the reduction to slavery is a sure way to prevent any rebellion.'[81] It is, for Simondon, to reduce them to the mythical creature of the robot.

Wiener's problematic however was never about an autonomous machine enslaving humans. It was about humans *using* others as if they were machines, controlling them such that they become as automatic as Palomilla was organic. Hence the title of his second cybernetic book which he had wanted to call *Cassandra* or *Pandora* as a wake up call to humanity (if a tragically unheeded one) until his publisher demurred, and which was instead titled *The* Human Use *of Human Beings*.[82] It is about humans *using* each other as machines, and about a virtuous *human* use for each other as *humans*. Certainly, in his *Prelude to* R.U.R. Wiener entertained the kind of sci-fi claim about machines enslaving humans that would have made Simondon squirm:

> Machines demand to be understood, or they will take the bread from the mouths of workers. Not only that, but they demand that we understand man as man, or we shall become their slaves and not they ours.

Doubtless also he considered real the danger of automation to human employment – just a few days after his *Prologue for* R.U.R. he declared that American labour would soon become so superfluous that whole industries would have to be nationalised and a 'Socialistic state' be imposed.[83] However the major threat of machines that he returns to consistently in his cybernetic writings is that humans will become stupefied through losing the game of secrecy, lies and bluff which cybernetics affords. They would lose all capacity for choosing their own ends and would become automata, dependent on superiors for programming.

In his last book *God and Golem,* Inc. (1964), Wiener describes being familiar with a certain kind of engineer and manager, mostly within America, which he has come to call a 'gadget worshipper'. Such a 'devoted priest of power' strives to create workers who are 'capable of great industry but of little independent initiative. … Meek, self-effacing, and wholly at his disposal … Limbs at the disposal of his brain.' They serve those above them entirely and shirk all personal responsibility. Chance, superiors, unquestionable policies and 'a mechanical device which one cannot fully understand but which has a presumed objectivity' – an apt description for a popular understanding of today's machine learning algorithms – are all claimed as responsible instead. The gadget worshipper is precisely the figure who in the earlier cybernetic writings he derides as 'not in their full right as responsible human beings, but … cogs and levers and rods' with respect to which 'it matters little that their raw material is flesh and blood'.[84] Finally in this text Wiener not only refers to *R.U.R.* in print – 'such subordinates are contemplated by Čapek's play' – but he also gives an example of one: Adolf Eichmann.[85]

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Notes

1. Walter Prichard Eaton, *The Theatre Guild: The first ten years* (New York: Brentano's, 1929), 66, 113, 253.
2. By my count *RP*'s roughly 1,500 contributors have referred to robots in these three ways. First, as an ontological other, primarily an economic one, against whom humans must compete ('Will a robot take *your* job?', asks Amelia Horgan in *RP* 2.11). Second, an existential sense whereby the robot is a standardised, reactionary and failed simulacrum of a qualified existence, in the sense that for Penelope Deutscher, Simone de Beauvoir oft por-

trays women who 'reduce themselves to robotic, slick or passive stereotypes of femininity' (*RP* 96); or C. W. Mills admonishes 'cultural domination' for producing 'cheerful robots' (Vincent di Norcia, *RP* 12); and Mary Daly, according to Jean Grimshaw (*RP* 49), depicts male interactions as tending to leave women 'lobotomised, moronised, robotised; as fembots, as the "puppets of Papa", even as "mutants"'. In the hands of the Western right, this existential sense has from the start had an acutely Sinophobic signification, from *The Times* being quoted back in *RP* 8 as depicting 'the ordinary Chinese' as 'robotised like an army' to the implicitly robotic way in which compliance to Covid-19 restrictions has been racialised in the West (Jana Cattier, *RP* 2.12). Related, it pertains to the trope of a neurodivergent Other, in the sense that Paulo Virno identifies the autist with the humourless AI (Jeremy Gilbert, *RP* 154). Third, a broadly-'cybernetic' position which acknowledges as historical fact and universal political theatre our '*robotically adjusted life*', in Achille Mbembe's words (*RP* 200); a position comparable to Donna Haraway's cyborg (Marsden, *RP* 78) no less than Claudia Aradau and Mercedes Bunz's depiction of 'AI [as] a distributed sociotechnical system' (*RP* 2.12); and Finn Brunton's playful dialogue with a chatbot of his own creation (*RP* 164), all of which deny the ontological separation and moral priority of human before their machines.

3. Jeremy Gilbert, 'Having a laugh', *Radical Philosophy* 154, 2009, 62–64.

4. Henri Bergson, *On Laughter*, trans. Cloudesley Brereton and Fred Rothwell (London: Macmillan, 1921), 9-10.

5. Ivan Klíma, *Karel Čapek: Life and Work*, trans. Norma Comrada (North Haven: Catbird Press, 2001), 78–84.

6. ibid., 72–73.

7. Aaron Bastani, *Fully Automated Luxury Communism: A Manifesto* (London: Verso, 2019)

8. Louis Chude-Sokei, *The Sound of Culture: Diaspora and Black Technopoetics* (Middletown, Conncticut: Wesleyan University Press, 2016), 63–68.

9. Paul Virilio, *The Information Bomb*, trans. Chris Turner (London & New York: Verso, 2000), 135.

10. Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society*, 1st ed. (London: Eyre / Spottiswoode, 1950), 60-61, 102, 209, 214.

11. Norbert Wiener, *Prologue for* R. U. R. *(5 May 1950), https://archivesspace.mit.edu/repositories/2/archival_objects/151494*, Cambridge: MC22, box 29b, folder 657, MIT, MIT Archives, Cambridge, MA

12. See for example, Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society*, 2nd ed. (London: Sphere Books, 1954), 157.

13. *Dictionary of Untranslatables: A Philosophical Lexicon*, ed. Barbara Cassin et al., trans. Steven Rendall et al. (Princeton and Oxford: Princeton University Press, 2014), 534.

14. Paul W. Mandel, 'Cabbages & Kings: Deus ex Machina', The Harvard Crimson, 10 May 1950, https://www.thecrimson.com/article/1950/5/10/cabbages-kings-plast-friday-and/; W. K., 'Revival of R. U. R. With New Prologue: Presenting Palomilla As Plato Said', *The New York Times* (New York), 7 May 1950, accessed 9 August 2017, https://www.nytimes.com/1950/05/07/archives/revival-of-rur-with-new-prologue-presenting-palomilla-as-plato-said.html. See the remarkable collection of photos and texts relating to Wiener's moth/bedbug at: Reuben Hoggett, '1949 – Wiener's Moth "Palomilla" – Wiener / Wiesner / Singleton', Cybernetic Zoo, 9 September 2009, https://cyberneticzoo.com/cyberneticanimals/1949-wieners-moth-wiener-wiesner-singleton/.

15. Wiener, *HUHBa*, 192–195; Wiener, *HUHBb*, 142–145; Ronald R. Kline, *The Cybernetics Moment: Or Why We Call Our Age the Information Age* (Baltimore: John Hopkins University Press, 2015), 76–77.

16. Norbert Wiener, *I Am a Mathematician: The Later Life of a Prodigy* (Cambridge, MA: MIT Press, 1956), 252-54.

17. H. T. Friis and A. G. Jensen, 'High frequency amplifiers', *The Bell System Technical Journal* 3, no. 2 (1924): 181–205; H. S. Black, 'Stabilized Feedback Amplifiers', *Bell System Technical Journal* 13, no. 1 (January 1934): 1–18.

18. First was published in, Norbert Wiener, Arturo Rosenblueth and Julian Bigelow, 'Behavior, Purpose, Teleology', *Philosophy of Science*, no. 10 (1943): 18–24.

19. Norbert Wiener, *Cybernetics: or Control and Communication in the Animal and the Machine*, 2nd ed. (Cambridge, MA: MIT Press, 1961), 39. Daedelus is depicted in both Plato's *Euthyphro* (11d4) and *Meno* (97d4) as having invented statues which moved of their own accord, as well as the wooden cow which was so realistic that the Cretan Bull would mate with it and thereby cunning Pasiphaë who was hiding inside. (Diodorus Siculus, *Bibliotheca historica* 4.77).

20. Hero of Alexandria, *On Automata*, 1.1, 1.7. Translation of Francesco Grillo, 'Hero of Alexandria's Automata: a critical edition and translation, including a commentary on Book One' (PhD thesis, University of Glasgow, 2019), http://theses.gla.ac.uk/76774.

21. Hero, *On Automata*, I.

22. ibid., 114-17.

23. ibid., 1.9.

24. G. W. Leibniz, *Philosophical Papers and Letters*, 2nd ed., ed. and trans. Leroy E. Loemker (Dordrechy, Boston & London: Kluwer Academic Publishers, 1969), 460; Peter R. Anstey, *The Philosophy of Robert Boyle* (London: Routledge, 2000), 55-60; René Descartes, *The Philosophical Writings of Descartes*, trans. John Cottingham, Robert Stoothoff and Dugald Murdoch (Cambridge: Cambridge University

Press, 1984), I.99–108; Thomas Hobbes, *Leviathan*, ed. Richard Tuck (Cambridge: Cambridge University Press, 1996), 9

25. Norbert Wiener, *God and Golem*, Inc. (London: Chapman & Hall, 1964), 37.

26. Daniel Nemenyi, 'What is an internet? Norbert Wiener and the Society of Control' (PhD thesis, Kingston University, 2018).

27. Erwin Schrödinger, *What is Life? The Physical Aspect of the Living Cell* (Cambridge: Cambridge University Press, 1992), ch. 6; Wiener, *Cybernetics*, 11, 41.

28. Wiener, *Cybernetics*, 40–42. That Wiener here singles out the pioneering mathematical biophysicist Nicolas Rashevsky as such a 'conservative physiologist' is interesting given Rashevsky's groundbreaking neural network model having become a staple concept of the early cybernetic group via Walter Pitts (his student) and Warren McCulloch, and from there into machine learning and the very architecture of the internet today. A critical juncture worthy of future consideration. See, Tara H. Abraham, '(Physio)logical circuits: The intellectual origins of the McCulloch–Pitts neural networks', *Journal of the History of the Behavioral Sciences* 38, no. 1 (2002): 3–25, https://onlinelibrary.wiley.com/doi/abs/10.1002/jhbs.1094.

29. Wiener, *Cybernetics*, 42, 132.

30. Thomas Sewall, *An Examination of Phrenology: In Two Lectures*, 2nd ed. (Boston: D. S. King, 1839), 59.

31. 'We have already spoken of the computing machine, and consequently the brain, as a logical machine. … Here the chief work is that of Turing['s 'On Computable Numbers with and Application to the Entscheidungsproblem' (1936)]. We have said before that the *machina ratiocinatrix* is nothing but the *calculus ratiocinator* of Leibniz with an engine in it; and just as modern mathematical logic begins with this calculus, so it is inevitable that its present engineering development should cast a new light on logic.' Wiener, *Cybernetics*, 125.

32. ibid., 42, 132.

33. ibid. Sewall considers a possible phrenological position that, '[the brain] is a secreting organ, and elaborates thought *as the liver does bile* from the blood'. That it can be coherently deployed doubly both to depict the operational image of the clock as well as that of thermodynamics, as described above, may be in lieu of its own echo of Pierre Jean Georges Cabanis' earlier more mechanically cause-and-effect description of the liver and brain as activated by food and impressions, respectively, which cause them to produce bile and thought. See, Sewall, *An Examination of Phrenology*, 59, emphasis added; Georges Canguilhem, 'The brain and thought', trans. Steven Corcoran and Peter Hallward, *Radical Philosophy*, 148 2008, 7–18; and Pierre Jean Georges Cabanis, *Rapports du physique et du moral de l'homme*, 3rd ed., vol. 1 (Paris: Hacquart, 1815), 127–28.

34. Wiener, *Cybernetics*, 132.

35. J. C. Maxwell, *The Scientific Letters and Papers of James Clerk Maxwell*, ed. P. M. Harman, vol. II (Cambridge: Cambridge University Press, 1995), 366–67; P. M. Harman, *The Natural Philosophy of James Clerk Maxwell* (Cambridge: Cambridge University Press, 1998), 138–389, 204.

36. Wiener, *Cybernetics*, 57–58. Wiener himself made fundamental contributions to the study of the movement of particles in the 1920s (the 'Wiener process' or 'Brownian motion'), Wiener, *I Am a Mathematician*, 37–39.

37. I do not wish to imply that invention of a relation between information and entropy was not Wiener's alone. Rather, his role is part of a succession of analyses effectively kicked off by Leo Szilard's 1929 paper, 'On the Decrease of Entropy in a Thermodynamic System by the Intervention of Intelligent Beings'. See, Harvey S. Leff and Andrew F. Rex, eds., *Maxwell's Demon: Entropy, Information, Computing* (Bristol: Adam Hilger, 1990).

38. According to Claude Shannon's simultaneously discovered concept of information, information is instead identified with entropy and probability, and opposed to noise, thereby taking the opposite sign. I leave this for another day, but to say that Wiener and Shannon consider the disagreement 'purely formal' and 'complimentary', respectively. See, Kline, *The Cybernetics Moment*, 15.

39. Wiener, *Cybernetics*, 58.

40. Margaret Mead, Gregory Bateson and Stewart Brand, 'For God's Sake, Margaret', *CoEvolutionary Quarterly*, no. 10 (June 1976): 32–44.

41. Martin Heidegger and Joan Stambough, *On Time and Being* (New York: Harper & Row, 1972), 58; Martin Heidegger, *Zollikon Seminars: Protocols—Conversations—Letters*, ed. Medard Boss, trans. Franz Mayr and Richard Askay (Evanston, Il: Northwestern University Press, 2001), 95.

42. Yuk Hui, *Recursivity and Contingency* (London: Rowman & Littlefield, 2019), 119–22

43. Wiener, *Cybernetics*, 125.

44. ibid., 58.

45. Translations of the *Monadology* based on, G. W. Leibniz, *Leibniz's* Monadology*: A New Translation and Guide*, ed. and trans. Lloyd Strickland (Edinburgh: Edinburgh University Press, 2014).

46. Descartes, *Discourse on Method*, *The Philosophical Writings of Descartes*, I.38–39.

47. One laments the fact that so much scholarship treats metastability as having been coined by Gilbert Simondon, who would have certainly inherited the concept from Wiener's discussion of the Maxwell demon in Wiener, *Cybernetics*, 58–59.

48. *Apperception*, in *Encyclopedia Americana*, vol. 2 (New

York & Chicago: The Encyclopedia Americana Corporation, 1918), 82–83, by Norbert Wiener.
49. Wiener, *Cybernetics*, 41; Wiener, *HUHBb*, 22-23.
50. Lloyd Strickland, ed. and trans., *Shorter Leibniz Texts* (London: Continuum, 2006), 76. See *M*38.
51. Wiener, *Cybernetics*, 41.
52. G. W. Leibniz, *The Leibniz-Des Bosses Correspondence*, trans. Brandon C. Look and Donald Rutherford (New Haven: Yale University Press, 2007), 257.
53. David Mindell, Jerome Segal and Slava Gerovitch, 'From communications engineering to communications science: Cybernetics and information theory in the United States, France, and the Soviet Union', in *Science and ideology: A comparative history*, ed. Mark Walker (London: Routledge, 2003), 80; Bernard Dionysius Geoghegan, 'From Information Theory to French Theory: Jakobson, Lévi-Strauss, and the Cybernetic Apparatus', *Critical Inquiry*, Autumn 2011, 110; Wiener, *HUHBb*, 162.
54. ibid., 92–93.
55. See the footnote in, Benoît Mandelbrot, 'An Informational Theory of the Statistical Structure of Language', in *Communication Theory*, ed. Willis Jackson (London: Butterworths Scientific Publications, 1953), 489; Mandelbrot, 'Contribution à la théorie mathématique des jeux de communication', *Comptes rendus de l'Académie des sciences*, 234, (1952), 1345–1347.
56. Ferdinand de Saussure, *Course in General Linguistics*, ed. Charles Bally and Albert Sechehaye, trans., with an introduction by Wade Baskin (New York, Toronto & London: McGraw-Hill Book Company, 1959), 88–89 and 110.
57. ibid., 89.
58. Ferdinand de Saussure, *Writings in General Linguistics*, trans. Carol Sanders (Oxford: Oxford University Press, 2006), 143–44.
59. Claude Lévi-Strauss, *The Story of Lynx*, trans. Catherine Tihanyi (Chicago & London: University of Chicago Press, 1995), xi–xvii.
60. Wiener, *HUHBb*, 34.
61. ibid., 165.
62. 'One can also say that the absence of good is an evil and that the absence of evil is a general good.' G. W. Leibniz, *Political Writings*, ed. and trans. Patrick Riley (Cambridge: Cambridge University Press, 1988), 55.
63. Norbert Wiener, *Letter to Paul de Kruif*, Cambridge: MIT Archives MC22, box 2, folder 38, 3 August 1933.
64. Wiener, *HUHBb*, 164.
65. ibid., 113, 162–3.
66. 'Lunch with the FT: Chelsea Manning', *FT Weekend* 10/11 December 2022, 3.
67. I read *HUHBb*, 153, as referring to, C. E. Shannon, 'Communication Theory of Secrecy Systems', *Bell System Technical Journal* 28, no. 4 (1949): 663, 704.
68. See Kline, *The Cybernetics Moment*, 31–35.
69. Shannon, 'Communication Theory of Secrecy Systems', 663, 704.
70. John von Neumann and Oskar Morgenstern, *Theory of Games and Economic Behavior*, 3rd ed. (Princeton: Princeton University Press, 1953), 5.2.1, 47.
71. Wiener, *Cybernetics*, 159–60.
72. ibid.
73. Surkov himself considers the situation reversed: the people as entropy which the State must control. He identifies entropy with chaos, turbulence and instability – which is a mistake or, more likely, a ruse. The chaos of entropy, according to Wiener's cybernetics, is one of sameness, 'de-differentiation', death and utmost probability, which is to say precisely the controlled condition that a Putinist like Surkov would desire from Statecraft. Vladislav Surkov, '*Kuda delsia khaos? Raspakovka stabil'nosti*' [Where has chaos gone? Unpacking stability], *Aktual'nye kommentarii*, 20 November 2021, https://actualcomment.ru/kuda-delsya-khaos-raspakovka-stabilnosti-2111201336.html; Wiener, *HUHBb*, 15, 85.
74. Shoshana Zuboff, *The age of surveillance capitalism* (London: Profile, 2019).
75. André Robinet, *Le Défi Cybernétique: L'automate et La Pensée* (Paris: Gallimard, 1973), 114.
76. Warren S. McCulloch, 'The Heterarchy of Values Determined by the Topology of Nervous Nets', *The Bulletin of Mathematical Biophysics* 7, no. 4 (December 1945): 227; Bruno Latour, *The Pasteurization of France*, trans. Alan Sheridan and John Law (Cambrdige, MA & London: Harvard University Press, 1988), 164.
77. Daniel Nemenyi, 'Submarine State: On secrets and leaks', *Radical Philosophy*, 193 Sept/Oct 2015, 2–8.
78. Pierre Dubarle, 'Une nouvelle science: la cybernétique – Vers la machine à gouverner...', *Le Monde*, 28 December 1948, Wiener, *HUHBb*, 180.
79. ibid.
80. Wiener, *HUHBa*, 209.
81. Gilbert Simondon, *On the Mode of Existence of Technical Objects*, trans. Cécile Malaspina and John Rogove (Minneapolis, MN: Univocal, 2017), 15–17.
82. Kline, *The Cybernetics Moment*, 80.
83. *The Tech*, 70.27, 12 May 1950, 1.
84. Wiener, *HUHBb*, 161, 157.
85. Wiener, *God and Golem*, Inc., 58-61.