Art's profane walks in Nature:
The Revolution of Automata during the Enlightenment

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Revolutions
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The Shitting Duck of France was unveiled by its creator, Vaucanson, as the first automaton able to metabolise food and digest it, expelling waste just as a mortal duck, in the spring of 1739. This act questioned the idea that an inventor could utilise art in a godlike way, stealing from nature the previously unique ability to create life, which consequently terrified and inspired the entire western world. During the Enlightenment, a time of mechanisation of labour, the idea that human beings could be replaced by these enigmatic, never-tiring aberrations of nature created a cultural revolution.

Machines created in Alexandria, Egypt seemed to move spontaneously and of their own volition. These marvels were automata, from the Greek *automatos*, "acting of one's own will, self-moving." These automatons seemed to run by magic, but in truth they were early examples of complex machines. They employed levers, sets of counterweights, ratchet wheels functioning as cams, step-down gears, turbines, and other interlocking parts to execute a predetermined sequence of actions in response to encoded instructions. Their activities resulted from the carefully contrived movement of water, air, heat, and mechanical components.

These automata of ancient Egypt were intended as toys or tools for demonstrating basic scientific principles, including those built by Hero of Alexandria. This first-century inventor would be the most influential of the ancient mechanicians in later periods. When his writing on hydraulics, pneumatics, and mechanics were translated into Latin in the sixteenth century, Hero's readers initiated reconstruction of his machines, which included siphons, a fire engine, a water organ, and

various steam-powered devices- and then proceeded with the construction of even more elaborate mechanisms. Soon large-scale automata, conceived as artificial wonders and designed to further allegorical programs, heightened the fascination of Renaissance and Mannerist gardens. Though necessity and practical innovation are the obvious drivers of technological advance, imagination was the prerequisite in creating the pre-programmed complex machinery known as automata.

The beginning of modern automata was started with the bombastic opinion of Descartes when he suggested that the bodies of animals are nothing more than complex machines- the the bones, muscles and organs could be replaced with cogs, pistons and cams. He dared not extend his dangerous allegory to man himself, but said as much as he dared without imperilling his life. Both Galileo and Copernicus before him has revealed the 'mechanistic laws of nature, but Descartes felt it was left to him to extend the idea of a machine from the heavens and into the domain of living organisms. Descartes ushered in Liebnitz's utopian programme, welcoming in the universal application of mathematics to all problems of nature, man and society.

Descartes must have been influenced by the automata that he had seen or heard about, for his description of the human body bears an unmistakable resemblance to the mechanical statues of his time. His representation of the nerves as hollow tubes seems to have been modelled on the bell ropes used to summon a servant. These nerves were supposed to manipulate valves in the head which in turn directed the follow of 'animal spirits' from the brain to the muscles, the pineal gland, in which Descartes located the mind, serving as a master valves which could overrule all the others.

In his basic concept of the flow of 'animal spirits' he employed a hydrostatic model which was not his own creation. The idea is encountered in a more rudimentary form in Hume, who speaks of a 'liquid soul' which has something in common with the sap of trees, the juice of the grape, and the flow of a river. Thales elevated this Homeric image to the status of a philosophical concept,

and it has remained persistently popular as a model in neurophysiology. The idea of *libido*, which also implies a hydrostatic model, and which Freud enthroned at the centre of psychoanalysis, may be derived from the Latin *libare* (to pour liquid); hence a flow of energy. There is a story that Descartes himself constructed an automaton that he called *Francine*, and that during a sea voyage, an inquisitive fellow traveller opened the case in which *Francine* was lodged, and brought the robot to the captain, who, thinking that it was the work of a sorcerer, threw it overboard.

Descartes found a worthy follower in Bayle, whose scepticism cleared the path for the French encyclopaedists of the eighteenth century. Bayle struggled to prove that the soul of the beast is potentially equal to the soul of man. The difference between man and beast, he argued, is 'accidental' not essential, and due to relatively superficial differences in physical appearance and organs. If so, we face the dilemma: either man's soul is mortal, or that of the beast is immortal. Voltaire puts a point of view sympatheric to the mechanistic philosophy of Descartes in the mouth of a wise old Jansenist, Gordon, in the *Child of Nature*. Gordon explains to a simple savage, a Huron from North America, that everything about us is somehow linked with our physical nature. Every secretion is of advantage to the body; and everything that is good for the body is good for the soul. In short, we are mechanisms in the hand of Providence.

All this seems very credible to the Child of Nature, who affirms that 'we resemble little wheels in the huge machine of which God is the soul'. In the same author's *Micromegas* there is a description of the heron's pleasure in observing the movements of those little machines (i.e. men) in scrutinizing their feats, and in following all their doings.' A follower of Leibniz describes his soul as 'a hand which points to the hour while my body chimes, or, if you like, it is the soul which chimes, while my body points to the hour; or to put it in another way, my soul is the mirror of the universe, and my body is its frame: that is all clear enough.'

A few years later La Mettrie startled even his exuberant age with his provocative L'Homme-Machine, in which he swept from the universe all non-mechanical factors and transformed the dualism of Descartes into a mechanical monism operation in man to the same degree as in animal. Not only are all animals organized like machines, but also the human organism itself, in its entirety, is only a perfect form of animal-machine. La Mettrie was no doubt encouraged to make his grand extrapolation by the ingenious successes of contemporary horologists. Hence his analogy: 'Man is to the ape, to the most intelligent of animals, as the *pendule planetaire* of Hygens is to a watch of Julien Leroy.' La Mettrie crystallized the confusing trends of his day in masterly fashion, in his conception of 'a graded *chain of being* in which man and beast are but a link apart' (italics mine). He seems to have been the first to state the problem of mind in terms of physics, but his actual proof amounts to no more than a statement of empirical correlation between physiological and psychical events. For two decades from 1750 to 1770 La Mettrie excelled his contemporaries of the intellectual scene in the originality and forcefulness of his exposition of the man-machine philosophy. He paid a heavy price for his unorthodoxy: exile from his native France and later from Holland; his book *The Natural History of the Soul* consigned, by Government decree, to the flames; and all his ideas scorned, misrepresented, or neglected by posterity (Vartanian, 136).

'The problem of the "soul' of animals', as L.C. Rosenfield declared, 'is comparable to the quest for the philosopher's stone. The task is long, the goal is never to be attained; in compensation, many a precious discover is made upon the way, and from this labour lost the world at large reaps genuine profit. (Rosenfield, 5)' Few questions have been more passionately and persistently debated. Nevertheless, there are few today who would take a typical eighteenth century view that the entire debate had led to nothing.

The revolutionary views of Descartes put many odd ideas into the heads of his compatriots. In particular, his sharp distinction between mind and matter together with his conception of the

mechanical nature of the corporeal world in which man alone of all animals exercises some ghostly control over his own movements became linked with the idea of the golem. This provided a convenient target for satirists who wished to pour scorn on mechanistic philosophy in general, while, at the same time, gratifying their desire to tamper playfully with forbidden mysteries.

Rumblings hostile to Descartes were not long in coming. Cyrano de Bergerac delivered an entertaining farcical dialogue in his *Estate et empires de la lune*. The story begins with Cyrano, on the moon, a prisoner of the quadruped inhabitants. Taking him to be a true beast, they make him entertain them with his tricks charging an admission fee for the performance. One day he meets a fellow biped and their conversation amuses the moon-dwellers who interpret it as an expression of joy at being reunited. Cyrano in time learns the language of his hosts who conclude that he must be a poor specimen of their own species that unfortunately has only two legs instead of the 'normal' four les.

However, the lunar priests insist that Cyrano and his friend must be monsters, who walk in suppliant posture with heads turned heavenward bemoaning their sorry plight and beseeching their Maker to devoir our 'left-overs.' The moon-dwellers, say the priests, incline their heads downwards in proud contemplation of their possessions. Cyrano, they decide, is a featherless parrot, and they place him in a cage. But his sparkling wit makes them suspect that he is totally devoid of reason and ruled merely by instinct. This poses an issue for justice, which divides the city into two factions; those who believe that Cyrano is witty are excommunicated. At a State Assembly convened to reach a final decision, Cyrano defends the philosophy of Aristotle, whereupon the audience concluded that he must be an ostrich, and the verdict is: 'Back to the Cage." (Rosenfield, 115)

Another attack upon the Cartesian ideology was initiated in 1732 by Giles Morfouace de Beumont in his *L'Apologie des betes* in which a monster communicates a brutal attack on dualism.

Art's profane walks in Nature

The beast asks the question 'Who could endow a machine with the sensitive soul of a beast or with power of reproduction? The finest doll could never give birth to a baby doll, whereas beasts perpetuate their species.' (Rosenfield, 167)

The seventeenth century is specially distinguished by the fact that many of the ablest thinkers were imbued with the idea of extending the use of mathematical methods to every domain of human experience. The inspiration for this came in the first place from Descartes, whose mind was filled with enthusiasm for the *Admirable Science*, which he believed has been divinely revealed to him.

Seventeenth-century France was the birthplace of those ingenious mechanical toys that were to become prototypes for the engines of the industrial revolution. Thus, in 1649, when Louis XIV was still a child, an artisan named Camus designed for him a miniature coach, and horses complete with footmen, page and a lady within the coach; all these figures exhibited a perfect movement. According to P. Labat, General de Gennes Constructed, in 1688, in addition to machines for gunnery and navigation, a peacock that walked and ate.

These intentions probably inspired the illustrious duck of the master toy-maker, Jacques de Vaucanson, which won the heart and admiration of the whole of Europe. Vaucanson's flair for inventing mechanical devices revealed itself early in life. As a boy, he often accompanied his mother to her confessor; and while she wept with repentance, he is reported to have wept with weariness. In this state of 'disagreeable vacation', he was impressed by the uniform motion of the pendulum of the clock in the hall. His curiosity being roused, he approached the clock-case, and studied its mechanism; and what he could not discover he guessed at.

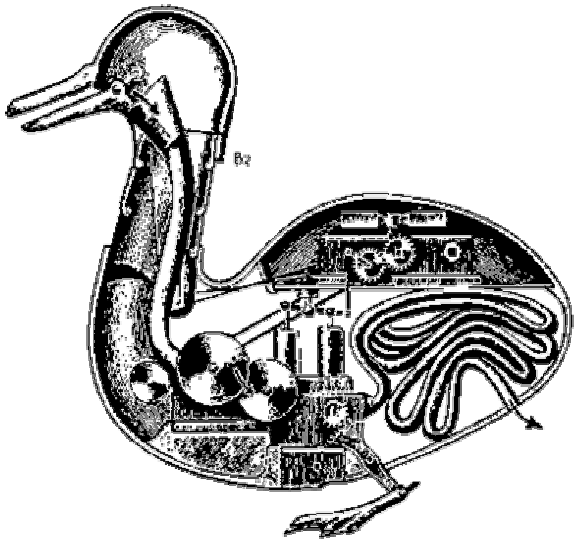
Art's profane walks in Nature

When Vaucanson presented the first of three spectacular anatomical automata to an admiring public in 1738, his subtly blowing and fingering flute player demonstrated the basic Cartesian principle that the body was a machine and that is multitude of bones, muscles, nerves, arteries, and veins operated just like the wheels and weights running a clock. Possibly inspired by the surgeon Claude-Nicolas Le Cat, whom he met in Rouen before going to Paris, Vaucanson aimed to transcend the pleasing adult toys of the day then being sold at Saint-Germaine and in the boutiques along the Pont Neud and the Palais Royal. There pantographically produced portrait silhouettes, talking heads, chess players, singing wind-up canaries in gilt cages, and mechanical pictures jostled ghostly shadow-puppet shows and pseudo-scientific demonstrations of optical, mechanical, and physical principles of the pre-Revolutionary era.

By 1740, Vaucanson was busy automating the French textile industry with punched cards- a technology that, as refined by Joseph-Marie Jacquard more than a half century later, would revolutionize weaving and, in the twentieth century, would be used to input data into computers and store information in binary form. However, it was his three mobbing *anatomies* that first incarnated the ethical dilemmas posed by smaller and smaller devices.

Both poetic specimens and mimicking hardware, his realistic creations aspired to duplicate anthropomorphic and zoomorphic forms in depth. Just as scientific research and curiosity could not easily be separated during the Enlightenment; neither could invention be divorced from the practical need to make money. Vaucanson quickly

capitalised on the commercial success of his first android, modelled after a recent sculpture by Antoiine Coysevox then in the gardens of the Palais des Tuileries, with the launch of a shepherd who played the tabor and pipe. The most acclaimed member of Vaucanson's trinity of entertaining equipment, however, was the notorious eating, digesting, and defecating duck. Whereas the rustic flutist inhaled, exhaled, and dexterously moved his fingers over a musical instrument, this barnyard variant of Phil's and Hero's bejewelled birds eagerly swallowed kernels of grain to excrete them in the metamorphosed shape of pellets. Unfortunately, this amazing transformation proved fraudulent.



The delicate droppings were not the natural result of simulated peristalsis but of a secondary device triggering the sphincter where a masticated plop lay hidden.

Much has been written about Vaucanson's automata. Goethe mentions them in his diary *Tag und Jahreshefte, and Achim von Arnim*, in his *Journey to Naples, Sicily, Malta and Sarfinia*, that describes the duck which he was able to see when it was exhibited at Milan. Sir David Brewster, writing in 1868, describes the duck as 'perhaps the most wonderful piece of mechanism ever made'. Let us see what Vaucanson himself had to say about it. His aim was, he tells us, to represent the viscera, and to simulate the functions of eating, drinking, and digesting.

The duck stretched its neck to take grain from a hand and then swallowed and digested it. It drank, paddled and quacked, and imitated the gestures which a normal duck makes when swallowing precipitately. The food was digested by dissoclution, not by trituration, 'the matter digested in the stomach being conducted by tubes, as in an animal by its bowels, into the anus, where there is a

sphincter which permits it to be released.' Vaucanson disclaimed any attempt to make a perfect copy of the process of digestion, although he doubted whether the anatomists would feel that anything was left to be desired in the construction of the wings, 'which had been imitated bone by bone'. Since his intention was to demonstrate, rather that simply to exhibit a machine, the internal mechanisms were fully exposed to view, though some ladies preferred to see them decently covered.

His other outstanding automata included a mandolin-player which sand as it played and kept time with its foot, and a piano player that moved its head and simulated the act of breathing. Vaucanson furtively cherished a secret ambition to make an artificial man. At the instigation of Louis XV, he did indeed attempt to make a model with heart, veins, and arteries, but he died before completing his task. He was responsible for the fabrication of many devices useful in industry such as a chair for weavers, but he was opposed by the French silk manufactures who threatened to kill him. There was no objection from the manufacturer to his image of Pan, which arose from a seat, played on a pipe, bowed when applauded, and then sat down; to an asp which, when touched by an actress, with the appearance of Cleopatra, ' flew at her breast with a malignant hiss'.

A technological genius, Vaucanson went on to invent the automatic loom, the first system for regulating a moving machine, and he designed the first specialised factories, suggesting revolutionary changes in production from start to finish. In contract to this other inventions, which provided solutions to practical problems, Vaucanson built his three astonishing automata solely for monetary gain. In the late 1730s, he toured them in Paris and the major cities of the continent and England, where they so charmed the public that they continued to be presented by other owners into the nineteenth century.

Following Vaucanson's success, automata of all sorts would entertain the general public and wealthy elite. Writing and drawing automata and musical automata similar to Vaucanson's were the

most common, but the most notorious was a life-size Turkish chess player who only occasionally lost a game to his human opponents. Other mechanical animals likewise strove to capitalize on the fame of Vaucanson's duck. There were birds that hopped from stick to stick in their ornate cages, a nimble mouse made of Oriental pearls, a caterpillar that fed on the foliage of a tree, and a 115-piece tarantula that simulated its living counterpart in many respects. (Bailly, 13-23) Such automata inhabit the last stanza of William Butler Yeats's "Sailing to Byzantium" (1926):

> Once out of nature I shall never take
> My bodily form from any natural thing,
> But such a form as Grecian goldsmiths make
> Of hammered gold and gold enamelling
> To keep a drowsy Emperor awake;
> Or set upon a golden bough to sing
> To lords and ladies of Byzantium
> Of what is past, or passing, or to come.

Vaucanson's Shitting Duck followed form of Descartes's mechanistic universe, and bolstered the belief during the enlightenment that animals were just meat machines, but automatons nonetheless. The ability to create life no longer was the domain of god and of living organisms, but was now captive in the hands of man's genius. These ideas terrified and excited many people, but was one of the major ideological changes from a natural to a mechanistic world view.

Art's profane walks in Nature

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