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# *"Homo ex Machina": A Historico-Philosophical Analysis of the Machine-Organism Analogy*

:: **Maurizio Esposito**

**Abstract**

From the early modern period onward, philosophers, naturalists, and physicians have speculated on the extent to which the organic body might be understood by analogy with machines such as automata, clocks, and other mechanical artifacts. This paper examines the assumptions underlying these comparisons, tracing the material and conceptual conditions that have shaped the perceived relations between organisms and artifacts. I argue that these comparisons must be situated within two dominant conceptions of the machine: an anthropocentric and a non-anthropocentric one. By reconstructing their historical emergence, I suggest that this distinction is crucial for understanding how continuities and differences between organisms and machines have been, and continue to be, conceptualized.

**Keywords**

Machine analogies; mechanism; organism; life sciences.

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## 1. Introduction

Since the Spanish Renaissance physician Gómez Pereira claimed in his *Antoniana Margarita* (1554) that animals are complex machines, many have speculated about the continuities and discontinuities between mechanical artifacts and living organisms. However, what has received far less attention is the nature of the relationship itself. In other words, when and how was the apparently self-evident idea that machines and organisms resemble one another crafted? Why did people come to believe that human-made devices and the living world might share something in common? In this paper, I aim to uncover some of the contexts in which this relationship not only emerged but also acquired its various meanings and legitimacy. More precisely, my aim is to challenge the assumed obviousness of the machine-organism analogy by uncovering the material and intellectual contexts that make it appear somewhat compelling.

This paper is admittedly brief, and I can only touch on the

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surface of a long and complex history, which I simplify by claiming that it hinges around two fundamental conceptions of mechanical artifacts: an anthropocentric and a non-anthropocentric one. The former defines the machine in relation to its capacity to substitute some aspects of human labor, whereas the latter regards machines as relatively autonomous entities whose organization and function are independent of human intention or utility. For brevity's sake, I will focus on one exemplary moment that illuminate the rationale behind these two conceptions: Marx's famous definition of "machine" in Chapter 15, "Machinery and Large-Scale Industry", of the *Capital*, Vol. 1, along with its fascinating connections to Charles Babbage. Rather than merely offering a further redescription of this episode, which has been aptly chronicled by Simon Shaffer (Schaffer S. 1994, Babbage's Intelligence: Calculating Engines and the Factory System, Critical Inquiry, 10.1086/448746, Vol. 21, No. 1, 203) and, more recently by Matteo Pasquinelli (Pasquinelli M., 2023, The Eye of the Master: A Social History of Artificial Intelligence, Verso Books 2834-703X), my aim is to reinterpret it in light of the long durée history of machine–organism relations and on the conflicting conceptions of what a mechanical artifact is (or might be). Finally, I argue that the most compelling justification for the connection between artifacts and organisms lies not in pretended self-evident isomorphisms or loose metaphors and analogies, but in human labor itself. It is the continuous, embodied experience of working with instruments and tools (later developed

into full-fledged machines), that first suggested a continuity between these artifacts and human limbs, and ultimately, between machines and the human (and eventually animal) body.

## 2. The will to "machine"

Strictly speaking, the origins of the organism-machine analogy long predate Gómez Pereira, Descartes, and other Renaissance thinkers, reaching back to antiquity. In *De Motu Animalium,* for instance, Aristotle famously compared animal motion to that of automata: "The movement of animals is like that of automatic puppets...the cables are released and the pegs strike against one another" (Aristotle, 1985, *De Motu Animalium*, (ed.) Nussbaum M., Princeton University Press, 9780691020358, 701b, 1985, 42). One may ask: why did Aristotle consider mechanical devices relevant for understanding a biological process such as animal motion? If anything, what ultimately justifies linking an artifact to a natural phenomenon? Aristotle himself expressed some hesitation regarding how far the analogy could be extended. In fact, in the very same paragraph quoted above, he noted that, unlike machines, animals possess internal processes like sensation and imagination. Aristotle cautioned against equating automatic puppets with genuine physiological processes, noting that any similarities we perceive are more pedagogical than ontological. His warning



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underscores that the analogy was far from transparent and required constant qualification. I argue, in fact, that for the analogy to be useful, the conceptual link had to be constantly reinterpreted and readapted to different disciplinary contexts, whether physiological texts, biological writings or mechanical treatises. Perhaps, a useful starting point is to trace the genealogy of the concept of 'machine' itself, and to see how the concept was originally intertwined with the organic and human world, is the pseudo-Aristotelian text *Mechanical Problems*.[1] In it, we find an influential and revealing definition of a mechanical device:

> For in many cases nature produces effects against our advantage; for nature always acts consistently and simply, but our advantage changes in many ways. When, then, we have to produce an effect contrary to nature, we are at a loss, because of the difficulty, and require skill. Therefore we call that part of skill which assists such difficulties, a device (Pseudo-Aristotle,

[1] In this context, Espinas A, 1897, *Les Origines de la Technologie: Étude Sociologique*, Paris : Felix Alcan continues to offer valuable insights. For a more recent study on the history of "machines" in the ancient and modern world, see Riskin J., 2016, *The Restless Clock: A History of the Centuries-Long Argument over What Makes Living Things Tick*, https://press.uchicago.edu/ucp/books/book/chicago/R/bo21519800.html, Chicago, University Press, 10.1007/s40656-018-0227-9; Di Pasquale G., 2020, *Le macchine nel mondo antico*, Roma: Carocci Editore, 978-8843095896

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1936, Mechanical Problems, (ed.) W. S. Hett, Loeb Classic, https://www.loebclassics.com/view/LCL307/1936/volume.xml, 847a, 331)

The apparent simplicity of this definition can obscure their deeper philosophical significance. It suggests that the real essence of a machine does not lie in its materials, structure, or functional organization, but in its ultimate function of a tool designed to assist or replace human labor. Implicit here is the central role of the human body and its limitations, as we build machines to perform tasks we cannot or prefer not to do ourselves. There is no generalized, theoretical or metaphorical resemblance between organisms and machines, but a direct, functional continuity: machines are extensions of the organic body designed to fulfill the same or comparable human tasks.

A similar perspective reappears in the first century BC in Vitruvius's *De Architectura*, where he defines a machine as "a combination of timbers fastened together, chiefly efficacious in moving great weights" (Vitruvius, 1914, The ten book in Architecture, Trans. M.H. Morgan, Harvard University Press, Book X, 283). To Vitruvius, a machine is any artifact made by humans to harness or resist the forces of nature in order to fulfill some specific labor. These definitions, drawn from both the Peripatetic text and Vitruvius, illustrate what I call the anthropocentric conception of the "machine"; according to which what matters most is not its structure,

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organization, or design, but the function it serves in fulfilling human needs. And because machines were understood as *proxies* of animal or human activity, it was scarcely conceivable to *identify* living organisms with machines. The former, after all, provided the original models for mechanical design, not the reverse.[2]

In the late nineteenth century, the geographer and philosopher Ernst Kapp expanded on this insight through his theory of organ projection, which suggested that every technical artifact was, in essence, an unconscious projection of a human organ.[3]

Interestingly enough, since the advent of Cartesian modernity, the explicit connection between machines and the organic body has become increasingly implicit. The idea of machines as *proxies* for human or animal labor gradually faded into an unexamined background, while the structure, kinematic and design became much more significant to define what a technical artifact is. Most importantly, the technical artifact was no longer regarded as a mere derivative

[2]Of course, in *Politics,* Aristotle entertained the possibility of a world in which automata could replace slaves. Yet this example did not imply that organisms are machines; rather, it suggested that slaves functioned much like machines.

[3]On the hypothesis of organic projection, see Esposito M., 2019, In the beginning was the hand: Ernst Kapp and the relation between machine and organism, https://revistas.uv.cl/index.php/RHV/article/view/1942, Humanities Journal of Valparaiso, 10.22370/rhv2019iss14pp117-138, 14:117-138

of the organic body but became the very principle through which that body could be explained. For many Cartesians, machines were significant less for their power to replace human labor than for their epistemic role in explaining life itself. That is why by setting aside the "human premise", the machine came to serve as the fundamental prototype for understanding organic entities. This "non-anthropocentric" perspective made it possible, at once, to conceive the machine as a prototype of life and to legitimize its identification with living systems.

Descartes exemplified the shift between anthropocentric to non-anthropocentric conceptions vividly. His idea of a 'machine' was not a proxy for specific human activities, but a template used to understand physical and biological phenomena. At the very beginning of his *Treatise on Man*, Descartes famously writes: "I suppose the body to be just a statue or a machine made of earth... We see clocks, artificial fountains, mills, and other similar machines which, even though they are only made by men, have the power to move of their own accord in various ways." (Descartes R., 2004, *The World and Other Writings*, Cambridge: CUP, 10.1017/CBO9780511605727, p. 99) Descartes did not start by defining the concept of a machine and then applying it to organic entities. Instead, he immediately compared organic entities to machines, treating the analogy as self-evident. He based the analogy an epistemic continuity between human and God. Just as the former build machines, the latter fabri-

cates living bodies. In this sense, machines are not only artifacts governed by natural laws or devices built to do some work: they are nature itself. The cosmos is a vast mechanism composed of smaller ones, including human beings. In this turn, the "machine" no longer reflects human labor or purpose; it becomes an abstract, non-anthropocentric model of the universe. This unique and powerful conception of "machine" becomes a heuristic template capable of mirroring both the microcosm and macrocosm.

The Cartesian view was widely adopted by most mechanists who followed in Descartes' wake. Nearly a century after his death, the French physician Julien Offray de La Mettrie, in his famous and controversial *L'Homme Machine* (1748), argued that the organic body was nothing more than a complex, self-regulating machine. It is the "machine" that explains the organic body, not the other way around. In the late nineteenth century, the British physiologist Thomas Huxley, in his influential essay "On the Hypothesis that Animals Are Automata, and Its History" (Fortnightly Review, 1874), maintained that the Cartesian project of using machines as templates for understand organic phenomena was more valid than ever.

Yet perhaps the most lucid articulations of this Cartesian, "non-anthropocentric" outlook emerged not from philosophers or physiologists (who seldom sought to define what a machine is) but from the makers of machines themselves. Indeed, just three years after Huxley's paper, the German

nineteenth-century mechanical engineer Franz Reuleaux, in his influential *Kinematics of Machinery* (1876), defined a machine as nothing more than: "... a combination of resistant bodies so arranged that by their means the mechanical forces of nature can be compelled to do work accompanied by certain determinate motions" (Reuleaux F., 1876, *The Kinematics of Machinery: Outlines of a Theory of Machines*, Macmillan and CO. 978-0486611242, p. 35). Reuleaux's definition aligns with many others of its kind, though he acknowledged that definitions of "machine" often vary and rarely agree with one another.[4]

Reuleaux, of course, did not entirely dismiss the role of human intention in defining machines. But he thought that the human element was relevant insofar as the specific performance of a machine is considered, i.e., in assessing how, and to what extent, the artifact accomplishes the task for which it was designed. However, the idea that a machine is essentially an extension of human labor is notably absent from Reuleaux's definition, as well as from those of many other 19th-century mechanical engineers. To summarize, since Descartes, machines are reconceptualized as ahistorical entities, as objects that can be studied and understood independently of the historical and contextual circumstances of their production. As they lose their ancient connection to human needs, machines begin to be seen as quasi-natural

[4]Reuleaux listed over twenty definitions of "machine", but most of them omit the human element entirely.

entities in their own right.

There is no doubt that many philosophical debates since the 17th century have unfolded against the backdrop of this remarkable modern idea: the non-anthropocentric conception of the machine. Yet, if machines are understood as extensions or projections of living organisms (as the anthropocentric conception holds) should the machine-organism analogy be radically reconsidered?[5]

In the next section I will provide only a very partial, short and tentative answer.

## 3. Marx among the "machines"

> On a closer examination of working machine proper we rediscover in it as a general rule, though often in highly modified forms, the very apparatus and tools used by the handicraftsmen or the manufacturing power... The machine, therefore, is a mechanism that, after being set in motion, performs with its tools the same operations as the worker formerly did with similar tools (Marx K., 1990, *Capital,* Vol 1.,

[5] On the hypothesis of machines as extension of the organic body, see also Canguilhem G., 2009, "Machine and Organism", in *Knowledge of Life*, https://www.degruyterbrill.com/document/doi/10.1515/9780823291977/html, Fordham University Press, 10.1515/9780823291977-007, 75-97.



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https://www.penguinrandomhouse.com/books/261069, Penguin Books, p. 494)

This famous passage appears in Book I of Marx's *Capital*, in Chapter 15, "Machinery and Large-Scale Industry." It exemplifies a well-known anthropocentric view of machines shaped by Marx's analysis of industrial production. The key message here is the conceptualization of machines as material extensions of human labor that replicate and replace human activities. Marx was possibly acquainted with the pseudo-Aristotelian definition of machine, but his explicit source of inspiration lies elsewhere. In fact, he was deeply indebted to Charles Babbage and his 1832 work *On the Economy of Machinery and Manufactures* (Babbage C., 2010, On the Economy of Machinery and Manufactures, https://www.cambridge.org/core/books/on-the-economy-of-machinery-and-manufactures, Cambridge: CUP, 10.1017/CBO9780511696374).[6] Known today as the father of the "computer" for his Difference and Analytical Engines, Babbage's deeper project reflected a unique view of machinery. Originally, a "computer" was a person who performed calculations. Babbage himself applied for such a role in 1814 but found it tedious, prompting him to invent a machine to replace human computers. While preparing his book, Babbage toured workshops and factories across England, studying manufacturing and exploring how to reorganize labor scientifically. In the early 19th century, figures

[6]Which was mainly discussed by Marx in the *Grundrisse*.



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like Babbage participated in industrial tours that were both educational and ideological performances. As Simon Schaffer noted, Victorian guides often celebrated machines not only for their technical prowess but also as symbols of industrial progress "... which enables a child, or the machine itself to operate on masses of metal, and to cut shavings off iron, as if it was deprived of all hardness, and so mathematically correct that even Euclid himself might be the workman" (Schaffer, 1996, 220).

Victorian enthusiasts imagined a future where sophisticated machines were operated by unskilled, cheap labor (mostly children or untrained workers). In this context, Babbage's Analytical Engine was more than an academic feat and marked a turning point in industrial rationalization. Designed as a Turing-complete machine, it could execute any instructions encoded on punched "numerical cards" that embodied human intentionality. The machine could act as a tireless, obedient servant to factory managers, enabling them to replace many workers with precise, docile automatons controlled by numerical input. But beyond its political implications and impact; what does it really mean that human labor is replaced by semi or fully automatic machines? Marx had his answer: through Babbage, he saw the machine as a human *proxy* synthesizing and embodying multiple tasks once requiring many hands and minds; "... the product is entirely made by a single machine, which performs all the various operations previously done by... several handicraftsmen

successively, either separately or as members of a system of manufacture" (Marx, 1990, 500)

A sequence of discrete operations could be reduced to a limited set of instructions, then encoded and effectively "compressed" into a machine, enabling a single device to perform the work of many laborers, whether skilled or unskilled. Babbage championed technological progress and genuinely believed (or at least professed to believe) that automation would liberate human beings from monotonous, dangerous, or physically exhausting tasks. Marx, by contrast, entertained no such optimism. In Volume I of *Capital,* he opens Chapter 15 with a revealing quotation he got from John Stuart Mill: "It is questionable if all the mechanical inventions yet made have lightened the day's toil of any human being." (Mill, quoted in Marx, 1990, 492). This line succinctly captures the central argument developed throughout his long chapter: the replacement of animal and human labor by machines did not improve the condition of workers: it worsened it. The true function of machinery, Marx argued, was never to lessen the worker's burden, but to increase the surplus value extracted from labor within the capitalist production process.

Under capitalism, machines serve a singular, overriding purpose: to reduce the cost of commodities by accelerating production. The immediate consequence of large-scale mechanization was the displacement of skilled workers, who were replaced by unskilled laborers; primarily women and



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children. This dynamic followed what became known as the "Babbage Principle," which held that complex tasks should be performed by highly paid specialists, while simpler, repetitive tasks should be assigned to lower-paid, less-skilled workers. Yet Babbage's ultimate vision extended further: to eliminate the need for skilled labor altogether by substituting machines and cheap, easily managed human labor.

Machines did not just replace human effort broadly; they took over complex, time-consuming tasks suited to mechanization. Tasks that remained for humans were typically assigned to unskilled laborers, as their wages were lower than the costs required to automate those tasks. For Marx, in fact, automation under capitalism followed a harsh pattern: machines replaced animals, then adult men, and finally pushed women and children into remaining roles. Rather than providing human emancipation, machines increased and deepened subjugation and enslavement. Marx saw machines as embodying the accumulated skills of human labor and offered a distinctly anthropocentric definition. Inspired by Babbage's manufacturing philosophy, he noted that machines replace not only human limbs but also mental work. Both saw machinery as collective social intelligence embodied in concrete artifacts, but while Babbage viewed the process as a positive outcome of science, Marx saw it as a potential burden imposed on workers by capital.

What I have shortly sketched here is the context and sub-

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stance of a more recent anthropocentric conception of the machine. According to this view, machines are *proxies* of certain functions of organic labor and thereby form an intimate connection with the living body. So intimate, in fact, that it is often mistaken for an identity. But by forgetting the diachronic ties between technologies and organisms, we also lose sight of the simple fact that mechanical technologies are nothing more than contingent outcomes of the unpredictable course of human history. This should seem deeply problematic to anyone who views machines and living beings as essentially the same. After all, why assume that technologies that came out of a specific and accidental history can tell us how living systems work? The supposedly ahistorical and non-anthropocentric idea of the machine (so dominant in our culture) is itself the product of a very specific history, one that we have yet to fully uncover and understand.

## 4. Conclusion

The concept of the "machine" has historically been framed in anthropocentric terms. It was conceived from the beginning not as an independent entity, but as a projection of human labor; a means of extending and substituting the capacities and tasks of the human body and mind. Yet, throughout modernity, this intimate bond between human bodies and mechanical artifacts gradually waned. As machines increasingly supplanted human labor, the human element

was paradoxically and deliberately bracketed out. Following Descartes' enthusiastic embrace of mechanical philosophy, a non-anthropocentric and de-historicized conception of the machine emerged; one that no longer regarded the machine as a derivative or proxy of human activity, but rather as the prototype for explaining all organic processes and functions. And yet, throughout the 19th century, anthropocentric views were often recovered from their temporary neglect. Babbage himself imagined machines capable of replicating the dexterity of human hands and the precision of human thought, an idea that deeply intrigued Marx. For both thinkers, machines were not alien entities, but projections of human labor, deeply rooted in the social and material fabric of life.

I suggest that this anthropocentric framework be seriously reconsidered today when examining the relationship between organisms and machines. The anthropocentric view shows that machines can only simulate those aspects of the organic world as functional stand-ins for human activity. But the persistent tendency to de-historicize mechanical artifacts have often obscured the way machines become "organs" for human labor. Acknowledging these anthropocentric origins allows us to understand machines not as objects independent of human *praxis*, but as historical and contingent artifacts that embody specific dimensions of human agency. In short, when we adopt an anthropocentric conception of the machine, the question of whether organisms are machines takes on a distinct philosophical (and often ethical) signifi-

cance, as the cases of Babbage and Marx compellingly illustrate.

Maurizio Esposito
https://orcid.org/0000-0001-6476-7997
Università degli Studi di Milano

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