CYBERNETIC COUNTERCULTURES INTENSIVE

Week 2. Organism and Artifact

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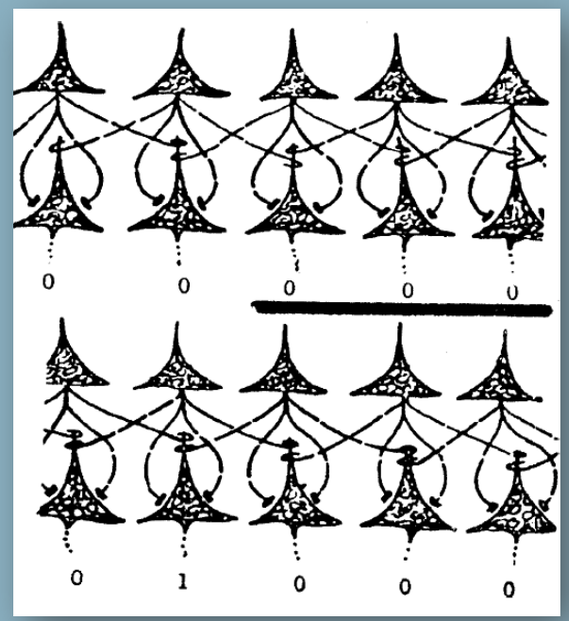
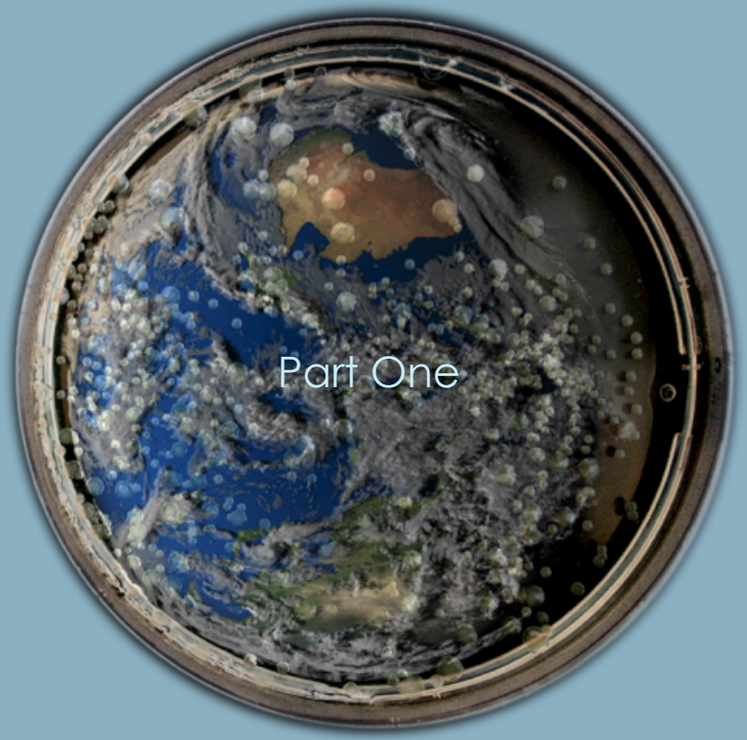
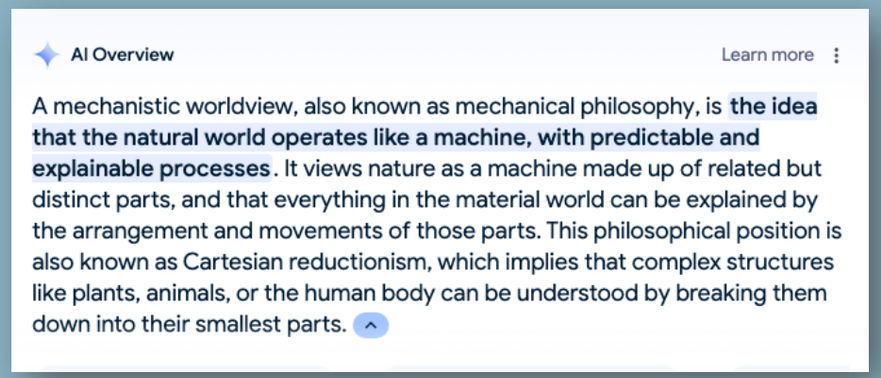




Organism and Artifact

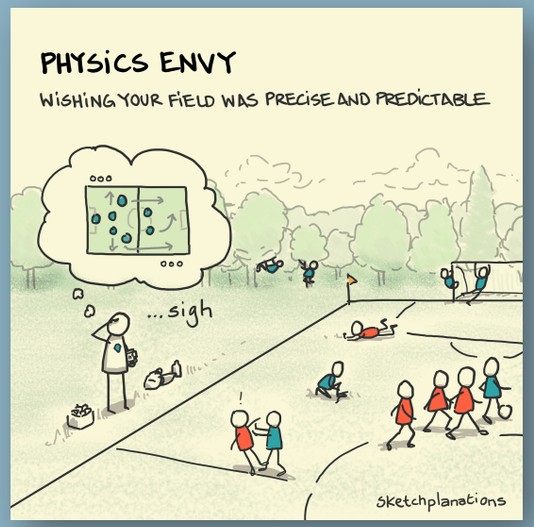
The mechanistic worldview is an ideology of knowledge associated with the rise of secular Western modernity and its scientific methods. Cybernetics itself began as a 20th-century offspring of the mechanistic worldview, then matured as a discipline with a rebellious, countercultural streak, in good part because of its heterodox relations to organisms and organic considerations. Let's look over the origins, the accomplishments, and the limits of the mechanical philosophy.

Searching Google on "the mechanistic worldview" on August 6, 2024, my first reply was an AI summary:



Thanks to the residual power of the mechanistic worldview, I now have this new technological affordance within my built environment ready to seize for my compositions, a network-based discursively-entrained large language model happy to generate text at any length. The text above will do nicely as a summary of the standard presentation of the topic: the idea that the natural world is itself a grand machine, and thus operates like a machine.

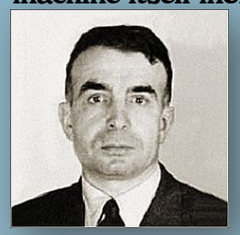
—Back when the mechanistic worldview had a lock on the scientific method, the research field that became biology was under some duress in the competition among natural disciplines to be equally fundamental, the keeper of its own ultimate knowledge. Modern science had already handed this crown to mathematical physics. In the most extreme mechanistic view, all there is that exists in the universe is matter and energy, and life forms are fundamentally epiphenomena of substance and force rather than emergent unities with new demands.



Lynn Margulis would say that many biologists suffer from P.E. That's right, "physics envy." Biology may be too messy to reduce entirely to clean formulas, but at the least, says the mechanistic worldview, we believe that it cannot have a final cause. It cannot have any more reasons for being than the material universe itself, a random event in the infinite void. For several centuries now, physics has given this rule to biology, that purposes shall have no place in the natural eddies of the material-energetic world.

—To open up this history further, let's check with a foreign observer of the formation of cybernetics, the French medical doctor and historian of of biology Georges Canguilhem. At mid-20th century, he wrote La Connaissance de la Vie (Knowledge of Life). In a chapter titled "Machine and Organism," he describes how the mechanistic approach projected its own mechanical forms upon the phenomenon of life. Or again, we have the idea that the natural world operates like a machine:

> **The relationship between machine and organism has generally been studied in only one way. Nearly always, the organism has been explained on the basis of a preconceived idea of the structure and functioning of the machine; but only rarely have the structure and function of the organism been used to make the construction of the machine itself more understandable.**

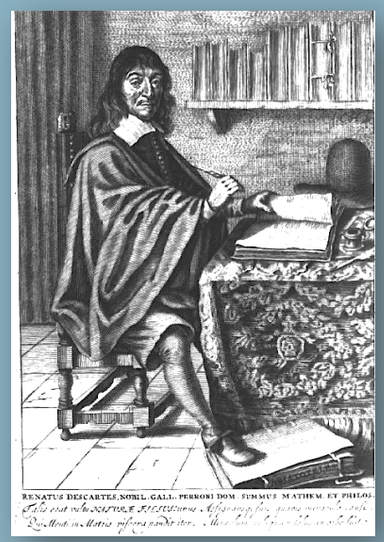


Georges Canguilhem, "Machine and Organism," from La Connaissance de la Vie (1952).

—In "Machine and Organism," after describing the ideo-logic of the mechanistic approach to the phenomenon of life, Canguilhem asserts an argument for the reversal of the mechanistic explanation. Rather, it is life that explains machines:

> **What I want to show is that the construction of machines can indeed be understood by virtue of certain truly biological principles.**
>
> —The key move in this argument rethinking the relation between organisms and artifacts is to shift from the mechanistic notion of uniformity of their functions to the matter of difference in their origination and construction—that is, parallel to but unlike the the generation and birth of organisms, to the circumstances by which machines come into existence at all. They turn out to depend on (the purposes of human and other) organisms!

—But first, Canguilhem traces the mechanistic worldview to one of its main sources in the 17th-century French mathematician and philosopher René Descartes (1596–1650). A passage from Descartes's Treatise on Man coordinates the mechanistic formula for the nature of human being as distinct from the rest of God's creations. While all living things have bodies of some sort, only humans have rational souls. In the human being the hands of God "joined" two contrary "natures": a body crafted as an exquisite machine and a rational soul to guide it.



First I must describe the body on its own, then the soul, again on its own: and finally I must show how these two natures would have to be joined and united in order to constitute men who resemble us.

I suppose the [human] body to be nothing but a statue or machine made of earth, which God forms with the explicit intention of making it as much as possible like us. . . .

We see clocks, artificial fountains, water mills and other such machines which, although only man-made, seem to move of their own accord in various ways; but I am supposing this machine to be made by the hands of God, and so I think you may reasonably think it capable of a greater variety of movements than I could possibly imagine in it, and of exhibiting more artistry than I could possibly ascribe to it.

—Modern science held on to Descartes's mind-body dualism while rejecting traditional teleological explanations for living beings—the idea that their individual existence or evolutionary survival fulfilled some purpose or design—as suffering a metaphysical hangover. Traditional teleology posits God, or His design decisions, as the final cause for the way things are or for what they become. The classical notion is that the telos of any particular being —its end, aim, or goal—determines its proper purpose and behavior: to arrive at the final state that God has preordained for it. But as God's purposes can only be a mystery, this was reasonably considered to be no way to proceed toward a rational understanding of "natural events." That's just the way it's meant to be may be reassuring, but it's not science.

—How do these quaint philosophical matters still play out in real practice? In his preface to Organisms, Agency, and Evolution, philosopher of science D. M. Walsh offers a relatively recent instance from his undergraduate course in ethology—the science of living behaviors:

> **When I took my first ethology course, I was instructed to make an ethogram. An ethogram is a catalogue of the movements, postures and sounds of a target organism whose behavior one wishes to study. The objective of the ethogram is to free the observation of behavior from any taint of purpose or intention. We were to identify behaviors with manifestations, rather than motives. I was told that my Columbian Ground Squirrels (Spermophilus columbianus) were standing on their hind legs at full height, rather than surveying the scene for predators. They were emitting a high-pitched "bark," rather than alerting their fellow colony members to imminent dangers. . . . I dutifully went along with this, even though I could see that my squirrels were looking for something, and warning each other. . . .**

Reflecting on this episode from his early scientific training, understood now as a problematic theoretical indoctrination, Walsh sizes up the quandary like this:

> Why should the phenomenon that demarcates the domain of biology be off-limits to biology?

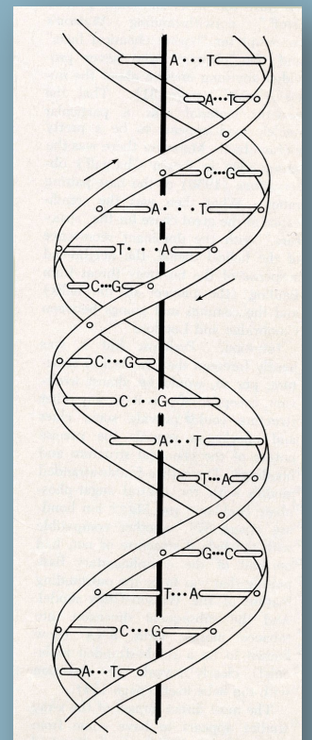
Walsh's way of putting the question implies that the phenomenon that demarcates the domain of biology is precisely purpose or intention—the attribute that he was instructed not to impute to the animal beings under his observation. Walsh continues:

> Since its inception, biology seems to have been torn by the evidently incompatible demands of treating organisms as natural entities, like everything else, and as singularly peculiar (naturally purposive) things, unlike anything else. One of the common strategies has been to attempt to minimize the distinctiveness of organisms, to show that the problematic nature of organisms is incidental to a comprehensive understanding of biology, and that the principles by which we account for nonliving phenomena are wholly adequate to the explanation of living phenomena. This is a bold move, and it is fair to say that it has paid dividends.

—As an especially bold innovation in the life sciences, precisely as Walsh points out, let's consider molecular genetics. It clearly minimizes the distinctiveness of organisms, in this case by reducing living diversity to combinatory biochemistries. For some observers, the macromolecules called genes—which are not in themselves living systems—are granted "selfish" purposes, while squirrels have none.

The distinguished editors of the collected edition Evolution " On Purpose": Teleonomy in Living Systems, including Stuart A. Kauffman, Denis Noble, and James A. Shapiro, remind their readers:

> **The so-called modern synthesis in evolutionary biology . . . assigns a central role in evolution to the genes and their supposedly random, incremental changes (mutations) over time. This has been the standard model in evolutionary biology for more than 80 years, and it was reinforced in the public mind by biologist Richard Dawkins' best-selling popular book,** The Selfish Gene.



DOUBLE HELIX. The two sugar-phosphate backbones twist about on the outside with the flat hydrogen-bonded base pairs forming the core. With these base pairs as the steps the structure resembles a helical staircase.

—And now, if we shift focus from biological function and behavior in a presently living system to the issue of biological evolution over the eons, the mechanistic worldview reappears in the form of random genetic mutations as the "purposeless" source of variations to be naturally selected. In the mechanistic view, evolutionary variation arises due to happenstance kinks in the transmission of genetic information. In the so-called modern synthesis of evolutionary biology, there can be no feedback from behavior to function beyond sheer survival.

All of these older evolutionary truisms are under strong challenge today. And yet they are still embedded in the standard discourse. The editors of Evolution "On Purpose" recount that,

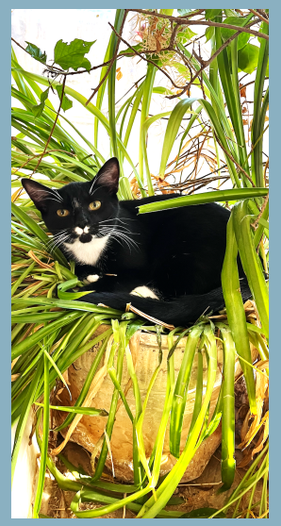
> **in the twentieth century, the original definition of teleonomy was qualified by making "the purpose or project" of an organism simply the working-out of natural selection acting on random genetic variations over time. Teleonomy was relegated merely to apparent purposiveness, . . . the "seemingly goal-directed behavior of organisms." Still today, Wikipedia tells us that teleonomy means only "the quality of** apparent **purposefulness." But this is not correct.**

As it reappears in evolutionary biology, once again, the long debate is over teleology—literally, the logic of goals—or as that term has been more recently modified, teleonomy, the control of goals, as autonomy is the state of self-rule, or self-determination.

In "Behavior, Purpose, and Teleology," Rosenbleuth, Wiener, and Bigelow redefine traditional teleology by aligning organisms and artifacts and then substituting the concepts of purpose and behavior for cause and effect. Once teleological behavior becomes synonymous with behavior controlled by negative feedback, organisms may be considered to be as purposeful and goal-driven as machines:

> **We have restricted the connotation of teleological behavior by applying this designation only to purposeful reactions which are controlled by the error of the reaction —i.e., by the difference between the state of the behaving object at any time and the final state interpreted as the purpose. Teleological behavior thus becomes synonymous with behavior controlled by negative feed-back . . . . [In contrast,] causality implies a one-way, relatively irreversible functional relationship, whereas teleology is concerned with behavior, not with functional relationships. [from "Behavior, Purpose, and Teleology"]**

That is, the concept of cause primarily concerns function: broadly considered, causes are posited to explain how things work. In contrast, purposes are posited to explain what systems do as they guide their behavior toward the realization of goals. Purpose-behavior relations rise to their own orders of complexity beyond more straightforward cause-effect relations. The abiding innovation here is that purpose-behavior relations produce regulatory dynamics when they are circular, that is, when they operate by means of feedback loops that cycle messages about outputs back to inputs, directing further functions to produce further behaviors converging on voluntary goals. In "What is Cybernetics?" Wiener contrasts the mechanical figures on a music box with:



the behavior of man, or indeed of any moderately intelligent animal such as a kitten. I call to the kitten and it looks up. I have sent it a message which it has received by its sensory organs, and which it registers in action. The kitten is hungry and lets out a pitiful wail. This time it is the sender of a message. The kitten bats at a swinging spool. The spool swings to the left, and the kitten catches it with its left paw. This time messages of a very complicated nature are both sent and received. The kitten is informed of the motion of its own paw by organs called proprioceptors or kinaesthetic organs. . . . By means of nervous messages sent by these organs, the animal is aware of the actual position and tensions of its tissues. It is only through these organs that anything like a skill is possible, not to mention the extreme dexterity of the

—Contemporaneously with Norbert Wiener's introduction of cybernetics, then, Georges Canguilhem advocates for a comparable turnabout in perspective giving the organization of living systems explanatory priority, especially in what today we would call their self-referential dimension.

> **We are now at the point where we can see the historical reversal of the Cartesian relationship between the machine and the organism. It is a well-known fact—and so need not be belabored—that in all organisms we observe the phenomena of autoconstruction, automaintenance, autoregulation and autorepair. . . .**
>
> **While there are machines that are self-regulating, these are in fact machines that man has grafted onto another machine. The construction of servomechanisms or electronic automata merely displaces the question of the man-machine relationship without changing it in any fundamental way.**

—The fundamental and perennial issues of causality, purpose, and teleology that engage Wiener et al show up again as Canguilhem sizes up the Cartesian moment in the mechanistic orientation of Western scientific rationalism:

> **In short, with the Cartesian explanation, it might appear that we have not moved beyond the idea of finality or inner purposiveness. The reason for this is that if we limit ourselves to the workings of the machine, everything can be explained by the theory of mechanism; but the theory cannot account for the construction of the machine itself.**

—Putting Descartes' God aside, Canguilhem returns humanity to its own métier as a creator and fabricator, as constructor, the subject of technical invention and use. The theory of the machine is also a theory of its fabricator:

> **If the functioning of a machine can be explained by relations of pure causality, the construction of a machine cannot be understood without taking two things into consideration: a specific goal-directed activity and man himself. A machine is made by man and for man, to achieve specific ends, to produce a given series of effects.**

—Observing organism and artifact side by side, Canguilhem's main conclusions were prescient in their anticipation of the organic, phenomenological, and existential vectors of the Cybernetic Countercultures.

> **. . . Thus, it is illusory to deny the idea of purposiveness in organisms and to attribute it to automatic functions, however complex we might imagine these to be. As long as a machine cannot construct itself, and as long as an organism is not equal to the sum of its parts, it might seem legitimate to think that biological organization is the basis and the necessary condition for the existence and purpose of a machine.**

—Yet once we acknowledge the priority of the organic, according to Canguilhem, we can also revalue the products of technology as "flowers" rooted in the biosphere:

> **. . . We can and must reverse the relationship of the watch to the tree and say that the cogs and generally all the components that make up a watch are designed to produce a desired effect: all the parts of the mechanism are products of imagination, each piece fulfilling some final purpose or design that at one time was only imagined or dreamed of; they are thus the direct or indirect products of a technical activity that is as authentically organic as the flowering of trees.**

The lines of organic cybernetics we will explore in this course push back on the prior minimization of purpose or intention in nonhuman organisms with a new level of attention to the distribution of agency throughout the biosphere. In conclusion for now, we can turn back to the article we discussed last week, "How Organisms Come to Know the World: Fundamental Limits on Artificial General Intelligence," coauthored by Stuart Kauffman, for a contemporary summary of the conceptual revolution set into motion by the organic turn in cybernetic thinking:

> The organism's ability to act is grounded in its **functional organization**, which grants it a certain autonomy (a "freedom from immediacy"). An organism not only passively reacts to environmental inputs. It can initiate actions according to **internal goals**, which it seeks to attain by leveraging opportunities and avoiding obstacles it encounters in its umwelt, that is, the world as perceived by this particular organism. These opportunities and obstacles are **affordances**, relations between the living agential system and its umwelt that are relevant to the attainment of its goals. **Organismic agency** enables a constructive dialectic between an organism's **goals**, its repertoire of actions, and its affordances, which all presuppose and generate each other in a process of constant emergent co-evolution.