

## Process

In *Mechanism and Biological Explanation* [Maturana 1970], Humberto Maturana and Francisco Varela argue that machines and biological forms are very closely related — so closely, in fact, that biologists can reasonably claim living systems are machines. This is not meant merely as a pedagogical metaphor, but rather as a rigorous analogy, which emphasizes important symmetries, and even better, expresses concisely specific experimental and theoretical aims. In what sense, then, are living systems machines?

A machine is defined by a group of abstract operations, satisfying certain specific conditions. An abstract machine is this system of inter-relations which is itself independent of the actual components which ‘realize’ the machine. A fishing boat can be made from many kinds of wood, sailed on many bodies of water, used to store many species of fish; a game of tag can be played with an arbitrary number of arbitrary people in any suitable space. What matters is not the specificity of a given component but the specificity of its relationships. We can define living systems as specific groups of components and their inter-relations, according to both abstract structure and specific functionalities. But insofar as we are only considering their structure, living beings are isomorphic to collections of finite groups of abstract machines: biology considers micro- and macro-structure, whereas systems theory studies inter- and intra-relations.

In short even the two styles of theorizing are quite closely related. Maturana and Varela are arguing that, just like abstract machines and actual living systems, our theories of living systems and our theories of machines are isomorphic. The two explanatory modes are, in some way, the same thought expressed twice, spoken in different languages and at different rhythms, for different people altogether. Yet the generic series of interrelations which they both describe have essential structural symmetries. A change in location just varies our perceptive horizon of possible actualizations, but not their underlying rule. It is precisely this ‘synthetic’ level of biological analysis which must invoke the immaterial plane of inter-relations. Whereas to analyze in terms of a machine is to identify rules of inter-dependence, modes of producing inter-activity which already imply a potential materiality. Either theoretical analysis produces a structural definition, independent from any particular material reality.

## Machine

This abstract-machinic level of analysis seems quite distinct from what we consider the engaged and active analysis in biology, observing and experimenting with living systems. But this indicates that we do not yet have a general theory of living machines of sufficient explanatory power. It is clear, at any rate, that we need both layers of analysis in order to understand living processes. Despite their apparent unity, we must examine the machine and the organism in both their concrete difference and abstract structure, both the concept model and the material instance. Indeed, these are the simultaneous and irreducible aspects of scientific explanation: “The structures of living systems and their actual (material) components are complementary yet distinct aspects of any biological explanation: they complement each other reciprocally but cannot be reduced to one another.”<sup>2</sup> Whether biology or cybernetics, we find an inherent double-articulation of inter-relations and intra-relations, of ontological rules and actual instances. The question in either case is not how the information is embodied or a specific component realized.

Rather, the cybernetic or biological question is how these abstract bodies of information are correlated, not the specific operation content (form) but the specification of operation (information.) The two sciences are the same, their problem spaces are isometric.

## **Order**

Our question is how to use theory to build new machines. Let's sketch out a potential theoretical apparatus capable of properly posing our question. We have considered that the concept of machinic autopoiesis in Maturana and Varela has a function in both biology and cybernetics. The important idea here was that it really had the same function in both disciplines, just on different scales. After all, autopoiesis is the raw material of individuation itself. Autopoiesis conditions possible modes of inter-relation and orderings of sub-developments. It regulates its own development, it is self-different and yet identical; it constitutes a turbulent yet stable flux which maintains a complex and well-adapted cycle of behavior, carefully "managing" the roles and inter-relations of components.

Cybernetics is about developing systems of control; the idealized abstract machine is more or less a perfectly decentralized machinic awareness, an image of the human mind itself, it would be a perfectly nebulous rhizomatic network, and would be aware as a swarm of submachines, even perhaps "alive" through this emergent consciousness within the algebraic balance of computational sub-components. As Raymond Ruyer wryly notes, we might fall into the dualistic fallacy less if there weren't any mirrors around! Sure, nature and our brains and society are a rhizomatic network; and there's really no reason to think we can't eventually develop computers exceeding human intelligence. Remember: the computer is really just a further evolution of mnemotechnics, memory technology. Computers are ideal symbolic manipulators, precisely because they are unaware of what they are manipulating. They promise to "forget" what the message is about, to transmit the signal innocently. We value this about computers now; but it may not be true in the future!

For now, at least, computers are without the human bias of caring about the information they are processing. Humans, of course, imagine they have an opinion about the world; and we imagine computers do not form such opinions, or anyway, that we haven't found any evidence yet that they do. They do not remember something unless told to; they have no autonomy, no desire. But how is human desire, human autonomy produced, at bottom? What are the machines of the unconscious which produce the strongest or most subtle desires, passions, impulses? The delicate chemistry of our instincts is the most sensitive and credible sense we possess. The question underneath all of this is the production of subjectivity; how do we regulate and preserve life and awareness? How do we measure the principle of difference, how do we calculate the origin of exteriority? How do we transform a theoretical inversion into an intervention into real situations, to actual new formations? A few notes, for now: (1) Life is structural, but it depends upon an a-structural 'reserve' of energy, or chthonic milieu. 2) Life is structured becoming, pulls itself out from an inner space. (3) Life produces scale, ordering, introduces zones and grids and metric planes into the universe, into itself, by mapping its local environment onto itself.

Our first conclusion here is that all measuring has to be brought down to a vital scale; more precisely, all scales are biological, they are produced and constrained by biology. They are

formed and deformed by sensation and imagination. (We cannot measure what we cannot imagine, what we are not clever enough to think up a way to measure.) The other point to notice is that our abstract model here is topological at root. The concrete model must be considered as a purely materialist, immanent conception. Life is time, light, energy, space — life is embodied. Cybernetics seeks to describe and produce systems of “control”; it is ‘information-architecture’ without ontology. What exists is energy embodied in a specific system; what doesn’t exist per se is the machinic form which is ‘clearly embodied. The immaterial is our theory of machines, the becoming-invisible. Both technological and biological systems ‘embody’ a specific immaterial form, and condition the production of new (sociotechnical, theoretical) formations. But each formation is always at risk of arising (or collapsing) due to a spontaneous, asymmetrical pulse.

[1] - Francisco Varela; Humberto Maturana. *Mechanism and Biological Explanation*. Philosophy of Science, Vol. 39, No. 3. (Sep., 1972), pp. 378-382.