

**the automatic divinity.
bergson and entomology**

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1. THINKING THE INSTINCT

Only a few thinkers have attempted to understand the insect throughout the modern tradition. Insects appear to inhabit a separate dimension, a latent nature that we find easy to push into the background. Human beings have needed to comprehend insects only as much as is required in order to govern them; a necessity that is due to insects' enormous number, their diffusion, and their capillary ecological integration. The aims of biopolitical exploitation, however, have dictated a substantial disregard for what properly pertains to this animal realm. In popular imagery, insects are usually depicted as nature's wind-up toys: nothing seems to suggest their being anything more than little moving machines. Unlike higher animals, insects offer no evidence of what we consider to be a

mind; it is also very difficult to observe them continuously within their own life conditions.

Whoever aims at addressing the insect world philosophically must develop ecological and immanent strategies of comprehension. A “philosophical entomology,” then, would have to extract its categories slowly from its opaque object through careful operations of alignment. Of the rare philosophers who have blazed this trail, Henri Bergson is maybe the most famous. In the well-known pages of *Creative Evolution*’s second chapter, Bergson takes the hunting wasp (or Sphex) as an example of life’s tendency to create unforeseeable yet infallible solutions. The Sphex “seems to know” exactly where to sting its prey, the caterpillar, in order to paralyze it without killing it, so as to feed it to its larvae. Bergson’s example is formulated on the basis of descriptions made by Jean-Henri Fabre, one of the fathers of modern entomology (and a passionate vitalist himself). Fabre dedicates many pages of his monumental *Souvenirs entomologiques* (completed in 1907) to this fascinating capacity possessed by certain wasps for maintaining their prey between life and death. The act is undertaken for fully practical reasons; the wasps thereby provide their children with fresh meat without endangering them. Their incredibly refined method is like a “transcendental chemistry”¹ that rivals the most advanced human science.

The main difference, says Fabre, is that whereas men acquire, pass down and enhance their knowledge, insects simply possess theirs. They never learn it. Taking the perspective of insects, then, requires us to plunge into the domain of instinct. Instinct is not learned and transmitted like a habit: it is inscribed in the species, belonging to every individual and constituting their existence. Where instincts are predominant, the individual being is fully immersed in an activity so as to coincide with it. An insect therefore “knows” what it has not learned: it is omniscient within the limits of the system to which its activity belongs. “The instinct,” Fabre writes, “knows everything, in the undeviating paths marked out of it; it knows nothing, outside those paths.”²

Bergson reformulates Fabre’s ideas, underscoring the point that in the event of the hunt, the wasp and its prey are “considered no longer as two organisms, but as two activities.”³ As the prey does not represent an object to the hunter, but instead the direction of a vital activity, their encounter takes place in the absence of any transitive operation (whether perceptive, inferential, or mechanic). The wasp and the caterpillar are put into each other’s presence within a continuous space of transformations, as they find themselves in the same ontological space. Their

reciprocal influence occurs by virtue of this original cohesion, which explains their incredible coordination. As an instinct unfolds, perception is subordinated to the participation in ontological fluxes that Bergson compares to musical themes⁴. Instinct, then, allows for a vision from within along the lines of an environmental texture: in Bergson's terms, it is based on a relation of "sympathy." Bergson further seems to suggest that this feature characterizes the living in general, not animals alone: "All goes on as if the cell knew, of other cells, what concerns itself; as if the animal knew, of other animals, what it can utilize."⁵

The undoubtable strength of Bergson's view is his affirmation of the specificity of instinctual behavior. Like Fabre, Bergson holds that instinct differs by nature from intelligence (a difference of degree would only pave the way to anthropomorphism). Here is an initial ecological principle: animal consciousness cannot be reduced to intellectual criteria, although this does not mean that it is unrelatable. Another characterizing aspect of Bergson's hypothesis is that it rules out Neo-Darwinian mechanisms, according to which life's solutions can all be traced back to complicated, mechanistically determined (and therefore theoretically pre-determinable) events and interactions⁶. An apparent weakness of Bergson's view, instead, is its failure to explain how instincts arise and evolve. All we know is that instinctual behavior never invents truly new solutions at the level of individuals, but requires an evolutionary modification at the level of the species⁷. The individual has only the power to exemplify the instinct, which remains always identical⁸. And yet, instinct share the same creative course as life itself⁹.

Bergson's main contention from the outset is that life is in itself a differentiating and genetic potency. We can therefore exclude that Bergson is arguing for an old-fashioned fixism, as he also explicitly avoids any form of creationism. Life creates forms to solve the problems of matter; it also radically overflows its material conditions. Instinct, as one of the main solutions of life, must itself be a creative movement. Now, taking Bergson's perspective, we can say that the more life ramifies, the more it loses its genetic power¹⁰. Primary differentiations like that of instinct and intelligence occur by sheer genetic impetus; but further ramifications, like the evolution of specific instincts, are in a much closer relation of interdependence with life's material conditions. Without dismissing Bergson's fundamental thesis, we can therefore admit that instinct varies according to environmental variations and genetic expression. *Instinct* is a product of life's creativity, but *instincts* and their realizations must be in some sort of relationship with their material and historical conditions. Bergson privileges a divergent model of variation, based on

the paradigm of evolution; at the extremities of life's divergent processes, however, another model stands out: that of ontogenetic convergence.

Instinct is mostly adaptive: changes occur in deep time, far below the temporal dimensions of human experience. Contingency, in this sense, plays a geological role in the evolution of instincts. Experimental studies based on the so-called "plasticity first" model¹¹ confirm, for instance, that insect instinct can be learned on a transgenerational level through epigenetic transmission¹². Seen this way, instinctual patterns consist of behavioral biases refined through experience and reinforced by the environment; these biases then evolve in a specific trait. Bergson explicitly excludes the Lamarckian inheritance of acquired traits, arguing against its anthropomorphic naivete. But left aside the confusion between human intelligence and instinct, we can still argue for a sort of "soft Lamarckism" that is not strictly at odds with Bergson's main contentions and allows for us to conceive the role of *plastic creativity* in Bergsonian terms. The idea that epigenetic variation can be transmitted across generations through epigenetic inheritance is actually well established in current biology¹³, and enables us to think plasticity as a subtler creativity of life. With Bergson, we concede that life can never consist in a mere re-arrangement of pre-existing elements, and that it always entails a creative predominance over its own conditions. But this predominance becomes more and more a balanced interaction when life builds organisms and single behaviors. Life progressively takes on a different rhythm as its impetus is divided.

Affirming that life's creative power is also plastic despite Bergson's aversion to Lamarckism helps to deepen a key concept in the Bergsonian theory of instinct, the concept of sympathy. "Instinct is sympathy," Bergson writes, just as much as life itself is¹⁴. We have said that the sympathetic nature of instinct corresponds to its capacity to establish a cohesive texture of activities: thanks to instinct, the wasp and the prey are put in the same space of transformations. We will define this ontological environment as *territory*¹⁵. A territory can be described as a finite, cohesive, continuous, anisotropic, non-homogeneous space, at the crossroads of the biological concepts of niche, environment and habitat. Differently from a surrounding space or a simple ecosystem, it is a set of material and immaterial trails and activities, a heterogeneous plane of patterns that creatively re-organizes biological functions on an ecological level. It is in many respects comparable to an undetermined set of phase spaces, as it represents the network of actual and virtual trajectories of sympatric living elements.¹⁶ These elements *adhere* to their territory, as they ontologically coincide with an evolving set of trajectories and attractors¹⁷. Like a biological niche, a territory is constructed by modification of

evolutionary constraints through dynamics of entanglement and endo-symbiotic association¹⁸.

A territory is fundamentally linked to the biological transmission of variations, as the very systematization that allows communicative propagation. A territory is all that involves the constant retranslation of genetically coded traits through their concrete expression and their further bottom-up elaboration. According to an epigenetic approach, “both the organism and the environment are in a continuous state of flux... In other words, changes in the environment produce changes in behavior, which, in turn, modify the environment. This transaction *is* development.”¹⁹ A territorial environment is therefore like “a whole open on itself.”²⁰ a topologically and semantically oriented transitional space, that involves by essence non-predictable changes. Sympathetic behaviors, then, are *navigational* as they are based on haptic orientation in a web of processes; they are also *plastic*, as they are continuous to a transitional habitat.

We suggest introducing the notion of territory as a figure of the ontogenetic convergence that characterizes instinct and that Bergson does not sufficiently address. In this way, it is possible to prolong Bergson’s view by linking sympathy, and consequently instinct, to ecological creativity: whereas intelligence separates a subject from the environment by means of abstraction and allows a mechanic kind of plasticity, instinct let an individual process stem from a territory, resulting in a morphogenetic plasticity. We can thereby define instinct as creative adherence to the conditions of life.

II. AUTOMATIC LIFE

If instincts are far too complex to be reduced to sets of blind mechanic reflexes produced by random mutations and selective mechanisms (as the Neo-Darwinian explanation posits), they also cannot be reduced, in Bergson’s view, to the mere effect of internalized actions. This critique of Lamarckism is shared by a refined biophilosopher and commentator of Bergson, Raymond Ruyer. In his article on *Bergson et la Sphex ammophile* (1959), Ruyer initially argues that Bergson overcomes the Neo-Darwinian perspective by attributing to instinct the characteristics of a non-cognitive and “cosmic” consciousness.²¹ Like developmental and morphogenetic organization, instinctual behavior is a way of acting, not a mechanic functioning: this means that instincts are unified and oriented fields, which are not explicable as simple combinations of external stimuli and internal drives.

Ruyer resorts to Bergson's insight into the ontological priority of nonlocal and non-linear semantic formations, the "themes": a pheromone trail, for instance, triggers an immaterial theme which comes to consist in that trail and in the actions it entails. The effect of the chemical medium is not mechanic: signal molecules do not bump about randomly until they find a receptor that fits (as on the "lock and key" model), otherwise life would not function. They do not operate according to shape, but rather to the power of establishing fields of resonating relations—a power that Ruyer defines as an "instinctive 'gnosis'."²² Ruyer doubts that instinct excludes perception, as Bergson believes. However, what Bergson fundamentally means—and Ruyer confirms—is that the stimuli do not function as mere mechanic triggers (like springs) but as expressive, semantic triggers (like memories, or better reminiscences). Experience data are in contact with an immaterial genetic dimension. This does not mean, however, that a semi-deliberate interaction with the environment is so meaningful as to directly retroact on the species, as claimed by the Neo-Lamarckians. Behaviors learned through intelligent experiments makes it possible to approach the nature of instinct, but they do not explain it. Habits do not cause instincts. Such a causal nexus would be too naïve, empirical, and anthropomorphic (as it mimics the modes of cultural inheritance)²³.

Neo-Lamarckism, says Ruyer, needs to be transposed on a metaphysical level by exploring the contact of actuality with a non-actual, speculative dimension²⁴. Here Ruyer takes up a Bergsonian lesson: life is creative power that consists of its own expressions. The non-actual or virtual dimension ("potentiality" as Ruyer calls it) is what compels to expressive manifestation. In every one of its moments, life continues to make itself inventively: acts of activation, elicitation, and expression of a genetic potential are always coessential to it²⁵. Virtuality realizes itself in actuality, and actuality *declinates* virtuality. In a certain measure, thus, the historical exerts an influence on the Being, where the Being "is not the undefinable principle of ontology: it is an essence mnemified by individual acts"²⁶. However, Ruyer explicitly argues against a symmetrical and reciprocal interaction between virtuality and actuality²⁷. As clarified by Gilles Deleuze and Félix Guattari, Ruyer's themes are "explainable neither as the encoding of a recorded phonograph disk nor by the movements of performance that effectuates them and adapt them to circumstances." A genetic situation "has a consistency that cannot be explained as a mixture of the innate and the acquired."²⁸ The metaphysical transposition of Lamarckism does not endow ecological inheritance with a real ontological role.

Although Ruyer remains anchored to the model of embryogenesis, both him and Bergson formulate an *expressionist solution* to the question of morphogenetic

creativity. In a brief passage of *Creative Evolution* (later developed by Ruyer), Bergson speaks of singular instincts as exemplifications and declinations of the identical instinct, comparing them to lines starting from the perimeter of a circumference and facing the same center. “In other words, instinct is everywhere complete, but it is more or less simplified, and, above all, simplified *differently*.”²⁹ Both expression and plasticity are descriptions of the convergent nature of instinct; but the expressionist solution privileges a top-down scheme of creativity, excluding the possibility of bottom-up influences³⁰. In this frame, actuality is expression of virtuality; there is no such thing as a creative experience of virtuality within nature.

Gilles Deleuze’s and Félix Guattari’s interpretation of Bergson, instead, comes much closer to this idea by underscoring the role of symbiogenesis and horizontal gene transfer. There is something “unnatural” in the contingent multitude of uncoded alliances that forms a territory, Deleuze writes³¹, something that refers to an *ethos* or a politics of nature, which is the bending of constraints under the influence of contingency. In this sense, the Bergsonian and Ruyerian themes tend to ontological hybridization and plastic reorganization. Life is always compositional; insects in particular are among the greatest symbionts in nature. This model is extended to all territorial communications: the affective coincidence of the hunting Sphecx with the caterpillar—or of the pollinating wasp with the orchid³²—are examples of creative communications between heterogeneous expressive materials³³. An affective ecology is only made possible by the immediate presence of a virtual exteriority, which is the non-homogeneous and “fibrous”³⁴ texture of a territory. The concept of territory epitomizes this co-evolutive and symbiotic bind of participation.

This interpretation allows for us to comment on another aspect of Bergson’s theory, the idea of natural technique. If the living invents ways of living, a territory can then be regarded as a set of existential and experiential techniques in which means and ends are immanent to the activity. A living relation (an “assemblage,” in Deleuzian terms) is an expressive machinery that precedes and informs its actors, a non-objectified way of composing with the world that involves bodies as pure affective nodes. Such relational activity is not reflexive in a cognitive sense—as it occurs in absence of any human consciousness—but in an ontological one, as it is self-organizing and spontaneously constructive. Strongly influenced by Guattari, Deleuze claims that themes are more “machinic” than organic, because the whole organicist perspective is vitiated by codification, hierarchization and mechanization of life.

That formulated by Deleuze and Guattari is not the only insight into the semantic field of the machinic. Gilbert Simondon—who, unlike Ruyer, glimpses the speculative importance of cybernetics—understands that a machine is an axiological whole, a virtual set of operations and informative activities. Like Bergson's hunting Sphecx faced with its prey, a technical object and its relational activity are one. This dynamic determination is carrier of a "margin of indeterminacy"³⁵ that represents its plasticity. Whereas a mechanism is made of contiguous parts connected by physical causes, and is itself a part dependent on exterior determinations, a machine is organic and integrated. A mechanism is discontinuous in structure and continuous in behavior; a machine is continuous in structure and discontinuous in behavior. In this sense, life in its course can be said to be machinic and not mechanic, as it functions by sympathetic and contingent assemblages (its co-evolving populations). If sympathy is machinic³⁶, instinct must be as well.

Recent interpretations have further explored this aspect through the idea of "automaton."³⁷ The automaton is the improvised device that life employs to function. From an ontological viewpoint, it is the territorial fold that make, for instance, two sympatric individuals of different species communicate. The automaton is also an immanent cause of creation. A hunt is not the simple behavior of an individual organism, but a non-individual *causa sui*, or a "perfect individuality lacking nothing"³⁸ and preceding its actors. When guided by instinct, an insect is absorbed in a constitutive process of self-enjoyment, a genetic law that realizes its existence³⁹. Considering all this, we can finally turn back to the question of the plasticity of a highly integrated character such as instinctual behavior. The environmental relation represents the reality to which the individual (carrier of the species' coded memory) adheres. We can even say that the transindividual code that defines a species is always connected to a particular environment and engraved in a particular zone of expression. In this sense, a territory is the automaton of all automatons, the super-machine.

III. NON-HUMAN ETHOS

Bergson links insects to instinct, and instinct to environmental sympathy. I have claimed that Bergsonian sympathy is not bound to fixity and utter determination, but rather to ecological cohesion and vital plasticity. To deepen Bergson's thesis is to conceive of the relation between the acting organism and the milieu as having a transcendental role and to understand the priority of territoriality. It is no longer a question of mediation between a subjective pole and an objective world: as the

idea of creative interaction comes to the fore, the idea of mediation diminishes in importance. It follows that Bergson's "biological machinism" does not hint at a "general organology,"⁴⁰ but rather at a *general automatology*. Technicity is no longer understood as the sphere of the material or symbolical complex of mediation between organism and milieu, but as the domain of impersonal ontological devices that orientate and constitute individuals. Technicity is the plane of natural *ethos*, the plane of morphogenetic creativity and non-human semiosis.

Here, the line that Bergson draws proceeds past Bergson himself. In the pages of *Creative Evolution*, instinct is described as an embodied technique: for Bergson, insects offer an example of elaboration of the environment through bodily means, in the absence of externalized instruments. This theory is apparently at odds with the fusional cohesion dictated by the notion of sympathy. Understood as carrier of a technique (however non-instrumental and non-symbolical), the insect is brought to do that which is essential to humans: it elaborates a separation from the environment. The only difference is that insects do not dispose of externalized organs. But if the activity remains immanent to the body, no action on a separated environment takes place at all: there is only the activity that brings together body and environment. There is no separation between being and activity here; therefore, there is no technique, only behavior, only *ethos*. By saying that insects display a non-externalized technique, Bergson appears to bring insect behavior back to human behavior, but in a defective sense, following a rhetoric that traces back to 18th century debates on animality⁴¹. In his view, technicity reunites instinct and intelligence as solutions to the same problem: they are just two different ways of using instruments to act on crude matter.⁴²

I argue that following *all* the consequences of the concept of sympathy entails a different view of non-human technicity. By reducing the distance between being and activity through the concept of embodiment, Bergson only begins to conceive of animal techniques as *ethos*. He does not follow this thread as far as he could, due to what appears to be a firmly anthropological idea of technology (an individual makes use of an instrument, be it organic or external to the individual itself). However, Bergson also claims that intelligence imposes a form on abstract matter through fabrication, whereas instinct treats matter as live and endowed with intrinsic forms. I now want to amplify this idea of active alignment with matter, of non-reifying and non-dominating affinity, in which matter itself is nothing but another manner of self-organization⁴³. In a living territory, the true subjects are the material paths of variations. Individuals intrinsically tend to matter: their aliveness turns back to the inorganic, as their existence knows no ontological

distinction between social, vital, and inert.

German naturphilosopher Henrik Steffens already observed that insects fabricate matter because the relations between themselves resemble those of some material formations, such as coralline reefs and crystalline structures. Insect productions like beehives and anthills can be seen as the materialization of a world of meanings to which insects adhere. Semiotic communication, at this level, entails the immersion in semantic regions governed by a *logica materialis* whose primal element is material interaction⁴⁴. Here the sign is a map of mobile correspondences: singing cicadas and grasshoppers form acoustic niches with sympatric species to organize their communities⁴⁵; ants build complex networks of biochemical trails that mark the environment outside their colony in order to collectively self-organize⁴⁶; moths assemble following electromagnetic attractant signals, their interactions made possible by a literal resonance⁴⁷. Insects are master communication technicians; communication is a territorial technique of participatory nature. At an even earlier level, that of the selection of meanings, there is no mediation between interpreter and referent, only a correspondence between mutually adapting entities. Meanings are not represented as symbols, they are directly participated. The conditions of interaction—namely the conditions of meaning—correspond to the territory itself.

Biosemiotics shows us that insect techniques are epiphenomena of communicative acts, and that communication and production of meanings are facts that pertain to life itself. Unlike instruments (intended in a narrow sense), organs are essentially navigational and non-objectified expressions of material-symbolical flows. However, biosemiotics does not usually go so far as to recognize that life itself is a behavior of matter (albeit very rare and peculiar). Following Bergson, we should emphasize the fact that a territorial cohesion does not know distinctions between organic and inorganic, subjects and objects, organisms and material world. In certain cases, for instance, insects show surprising attitudes of “assimilation to the surroundings”⁴⁸. Behaviors such as mimicry, intimidation, disguise, and camouflage, reveal that communication coincide with the emergence of an underlying heterogeneous unity that captures the individuals as an impersonal force. In those cases, by making an exhibition of itself, an individual becomes a live object for anonymous spectators—very similarly to the cases in which humans depose their identities in provisional structures of desire: in photographic or theatrical relations, for instance, or in certain sexual relations. These are all forms of individual detumescence and material dispossession that reveal a general tendency of becoming things among other things, anonymous signs of the

environment.

The swarm is another strategy of materialization of non-subjective meanings through subjectification of the environment. A swarm is an environmental behavior, in which portions of a territory creatively materialize. In a swarm of marching locusts or nest building ants, a certain number of individuals produces an emergent behavior that cannot be classified as either living or inert. A swarm behaves more like a lava flow than like a living organism: i.e., like a heterogeneous material that expresses a capacity for self-organization through non-linear dynamics and far-from-equilibrium conditions⁴⁹. Such a dynamic is clearly not pre-determined nor oriented by a represented goal; it is instead “highly dependent on the ‘white noise’ that nurtures creative processes” (Landeweerd 2021: 145). Not only do insects live in a continuous world of matter: they can also act like live matter. The porosity between organic and inorganic vitality is there to indicate that our traditional idea of “matter” needs a root-and-branch revision, and that life in general must be first of all distinguished from what is mechanic and homogeneous. In Bergson’s own understanding of life, after all, the life/matter duality is subsumed under the greater duality between the vital and the inert, the living and the mechanic.

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NOTES

1. Jean-Henri Fabre, *The Hunting Wasps*. Trans. by Alexander Teixeira De Mattos. New York: Dodd, Mead and Company, 1919, 15.
2. Fabre, *The Hunting Wasps*, 211.
3. Henri Bergson, *Creative Evolution*. Trans. by Alexander Mitchell. London: Macmillan, 1911, 183.
4. Bergson, *Creative Evolution*, 181. The notion of flux does not strictly belong to Bergson's terminology; I use it here as a metaphysical notion denoting a vital path, which descends directly from the élan vital.
5. Bergson, *Creative Evolution*, 176. Bergson's theory of instinct raised visceral reactions, as its perspective was difficult to reconcile with the hegemonic trends of 20th century biology. At least until the emergence of ethology during the 1950's, Bergson's theory was buried under neo-positivist skepticisms (see Fred Keijzer, "The SpheX Story: How the Cognitive Sciences Kept Repeating an Old and Questionable Anecdote." *Philosophical Psychology*, 26:4, 2013, 502-19). Only in recent years "the gothic beauty of Bergson's nightmarish and florid vision" has received proper attention (see Christian Kerslake, "Insects and Incest: From Bergson and Jung to Deleuze." *Multitudes* 25, Summer 2006. <https://www.multitudes.net/insects-and-incest-from-bergson/>). For a thorough reconstruction of the "SpheX story" see also the introduction of Raymond Ruyer, Tano Posteraro (translation and introduction), John Roffe (introduction), "Instinct, consciousness, life." *Angelaki*, 24:5, 2019, 124-147.
6. It is important to keep in mind that Bergson's interpretation of Darwinism is somewhat of a caricature of its subject. For the complicated relationship between Bergson and Darwinism see e.g. P.-A. Miquel, "Bergson and Darwin: From an Immanentism to an Emergentist Approach to Evolution." *SubStance*, 36:3, 2007, 42-56.
7. Bergson, *Creative Evolution*, 148.
8. Bergson, *Creative Evolution*, 180.
9. Bergson, *Creative Evolution*, 174.
10. Bergson, *Creative Evolution*, 276ff.
11. See Nicholas A. Levis, David W. Pfenning, "Evaluating 'Plasticity-First' Evolution in Nature: Key Criteria and Empirical Approaches." *Trends in Ecology and Evolution*, 31:7, 2016, 563-74.
12. Gene E. Robinson, Andrew B. Barron, "Epigenetics and the Evolution of Instinct." *Science*, vol. 356, issue 6333, 2017, 26-27. On the ecological development of instinct see Mark S. Blumberg, *Basic Instinct: The Genesis of Behavior*. New York: Thunder's Mouth Press, 2005.
13. See E. Jablonka, M.J. Lamb, *Epigenetic Inheritance and Evolution: The Lamarckian Dimension*. Cambridge (Mass.): Cambridge University Press, 1999; Massimo Pigliucci, Gerd B. Müller (eds), *Evolution: The Extended Synthesis*. Cambridge (Mass.)/London: MIT Press, 2010; Dominique Joly, Christoph Grunau (eds), *Prospective épigénétique, écologie et évolution*. *Les Cahiers Prospectives*, 8, November 2018.
14. Bergson, *Creative Evolution*, 186, 184.
15. A first speculative account of the concept is provided by Gilles Deleuze and Félix Guattari, *A Thousand Plateaus*. Trans. by Brian Massumi. Minneapolis/London: University of Minnesota Press, 1987; Pierre Montebello, *Métaphysiques cosmomorphes. La fin du monde humain*. Dijon: Les presses du réel, 2015, 129-156. I also consider the notion of "biological field" formulated by Francis Bailly, Giuseppe Longo, *Mathematics and the Natural Sciences: The Physical Singularity of Life*. London: Imperial College Press, 2011, 122: "Living systems in their interaction do not form a given field of physical forces – no minimum principle, no geodesic principle predetermines their evolution. For modern evolution (and we have for the present no better theory) they rather become more

or less compatible with a situation, which living systems themselves will have co-constituted and co-modified, rather than with one given in advance” (121). A living field, then, is “a second-order space of complexity which feeds back on itself splitting from the physical space” (Paul-Antoine Miquel, *Vénus et Prométhée. Essai sur la relation entre l'humain et la biosphère*. Paris: Kimé, 54). All this marks a shift to an interactionist, endogenous concept of locality in biology (see Ayelete Shavit and James Griesemer, “Mind the Gaps: Why Are Niche Construction Models So Rarely Used?”. *Transformations of Lamarckism: From Subtle Fluids to Molecular Biology*. Eds. Snait B. Gissis, Eva Jablonka. Cambridge (Mass.)/London: MIT Press, 2011, 307-18). For an additional description of this very concept I would refer to my article “Aesthetic Terraforming. Cosmo-morphologies for Troubled Times.” *Aesthetica Preprint*, 117, 2021, 201-18.

16. Bailly and Longo, *Mathematics and the Natural Sciences*, 250ff. In the sphere of the living, “we must shift from a determined trajectory to an intrinsic indetermination, comparable to the possible and indeterminate paths of quantum physics, but concerning the phase space itself” (254).

17. See Delanda’s definition of a Deleuzian multiplicity as a “nested set of vector fields related to each other by symmetry-breaking bifurcations, together with the distributions of attractors which define each of its embedded levels” (Manuel Delanda, *Intensive Science & Virtual Philosophy*. London/New York: Continuum, 32). See also Bailly and Longo, *Mathematics and the Natural Sciences*, 255-57.

18. Miquel, *Vénus et Prométhée*, 68-69.

19. David B. Miller, “Development of Instinctive Behavior. An Epigenetic and Ecological Approach.” *Handbook of Behavioral Neurobiology. Vol. 9: Developmental Psychobiology and Behavioral Ecology*. Ed. Elliott M. Blass. New York: Plenum Press, 1988, 417. As Deleuze and Guattari put it, a territory arises “in the free margin of the code” (Deleuze and Guattari, *A Thousand Plateaus*, 322).

20. Miquel, *Vénus et Prométhée*, 42.

21. Ruyer, “Instinct, consciousness, life,” 135. Through some adjustments, Ruyer deepens Bergson’s monism of life by leading both instinct and intelligence to primary consciousness and formative organization. Instinct, however, is not taken as a primitive direction of life, but as a single means of life, and at the same time as a metaphor for how life works: the instinct of the wasp is the instinct of the embryo. In Ruyer, the whole idea of life as a unity that evolves in different directions gives way to that of a vertical expression of forms: there is no unity precedent to the differentiation and no progressive separation, but a simultaneously differentiating life. Hence, instinct and intelligence are not mutually exclusive. For the Bergson-Ruyer dialogue, see the introduction to the said article.

22. Raymond Ruyer, “Instinct, consciousness, life”, 137. “The bee shapes the world according to the instinctive gnosis that characterize its specific Umwelt” (Raymond Ruyer, *Neofinalism*. Trans. Alyosha Edlebi. Minneapolis/London: University of Minnesota Press, 2016, 99).

23. “Neo-Lamarckians were deceived by the phenomenon of passage from the conscious to the unconscious, which seems to bring habit close to instinct. But active habits, at least within the bounds of our experience, become ‘unconscious’ only in the manner of a psychological ‘other-I’. They remain in the domain of the psychological in the ordinary sense of the term. A habit never assumes the character of an instinct nor especially the character of an instinct that forms organs; it never enters into the region of biological autosubjectivity. Secondary consciousness is never transformed into primary consciousness” (Ruyer, *Neofinalism*, 214-15).

24. Ruyer, “Instinct, consciousness, life,” 135.

25. “The bird that makes its nest is at once work and worker; by working at its nest it still continues to be worked” (Ruyer, “Instinct, consciousness, life,” 137).

26. Raymond Ruyer, *Eléments de psychobiologie*. Paris: Presses Universitaires de France, 1946, 149 (my translation).
27. Starting from the article *Causalité ascendante et causalité descendante* (1939), Ruyer has always excluded that actuality can have a real influence on virtuality, arguing for the priority of the “descending” type of creation (from virtual to actual). Plasticity, in this sense, is not creativity. On this see Laurent Meslet, *Le Psychisme et la vie. La philosophie de la nature de Raymond Ruyer*. Paris: L’Harmattan, 2005, 248-70.
28. Deleuze and Guattari, *A Thousand Plateaus*, 332.
29. Bergson, *Creative Evolution*, 180.
30. It is important to notice that plasticity does not exclude the notion of expression, as should be clear from the above definition of “territory”: it rather enlarges the concept of expression by admitting the ecological intertwinement of virtuality and actuality and its morphogenetic outcomes.
31. Deleuze and Guattari, *A Thousand Plateaus*, 240.
32. The encounter “does not link the wasp to the orchid, any more than it conjugates and mixes them: it passes between them, carrying them away in a shared proximity in which the discernibility of points disappears” (Deleuze and Guattari, *A Thousand Plateaus*, 234). On the famous Bergsonian and Deleuzian case of the wasp-orchid encounter see Carla Hustak, Natasha Meyers, “Involutionary Momentum: Affective Ecologies and the Sciences of Plant/Insect Encounters.” *differences*, 25:3, 2012, 74-118. For a Deleuzian reinterpretation of Bergsonian sympathy, see Elizabeth Grosz, *The Nick of Time: Politics, Evolution, and the Untimely*. Crows Nest: Allen & Unwin, 2004, part III; Jussi Parikka, “Insect Technics: Intensities of Animal Bodies”. *An [Un]likely Alliance: Thinking Environment[s] with Deleuze/Guattari*. Ed. Bernd Herzogenrath. Newcastle: Cambridge Scholar Publishing, 2008, 339-62; Brian Massumi, *What Animals Teach Us About Politics*. Durham/London: Duke University Press, 2014; Id., “The Supernormal Animal.” *The Non-Human Turn*. Ed. Richard Grusin. Minneapolis/London: University of Minnesota Press, 2015, 1-18.
33. Deleuze and Guattari, *A Thousand Plateaus*, 238.
34. Deleuze and Guattari, *A Thousand Plateaus*, 249.
35. Gilbert Simondon, *On the Mode of Existence of Technical Objects*. Trans. by Cécile Malaspina and John Rogove. Minneapolis: Univocal, 2017, 17.
36. “The assemblage’s only unity is that of a co-functioning: it is a symbiosis, a ‘sympathy’” (Gilles Deleuze and Claire Parnet, *Dialogues II*. Trans. by Hugh Tomlinson and Barbara Habberjam. New York: Columbia University Press, 2002, 69).
37. I mainly refer to Federico Leoni, *L’automa. Leibniz, Bergson*. Milano-Udine: Mimesis, 2019. Note that we intend the same notion in a slightly but significantly different sense, drawing from Deleuze’s and Guattari’s concept of assemblage.
38. Deleuze and Guattari, *A Thousand Plateaus*, 261.
39. “The insect,” Leoni writes, “is continuously in act, the insect is forever and ever in act. It is pure Aristotelian *energeia*, it is the “living, eternal, perfect god” of which Aristotle talks in the *Metaphysics* [...]. The Bergsonian insect is the Aristotelian god, but scattered everywhere in the biosphere, not separated or transcendent from its environment” (Federico Leoni, “Edipo e gli insetti.” *L’inconscio* 3, June 2017, 193). Unlike the Aristotelian “pure Act”, however, the automaton is not univocally necessary: it is a contingency that inventively gains consistency and can also become part of the code.
40. For Canguilhem, Bergson’s philosophy aims “to understand the true relationship of organism and mechanism, to develop a biological philosophy of machinism, to conceive machines as the

organs of life, and to lay down the base of a general organology” (Georges Canguilhem, “Note sur la situation faite en France à la philosophie biologique.” *Revue de métaphysique et de morale*, 52:3, 1947, 332).

41. Eighteenth century debates attributed an “artistic instinct” to animals and most evidently to insects, which are capable of admirable works of constructions entailing a measure of choice. However different from human doing, this character was interpreted as a way of constructively organizing the environment analogous to human production (see Göran Blix, “The Zoology of Mind: Instinct and Intelligence in Eighteenth- and Nineteenth-Century Natural History”. *L'Esprit créateur*, 56:4, Winter 2016, 52ff.).

42. Bergson, *Creative Evolution*, 148-50. Bergson maintains the notion of instrumental action even though he acknowledges that “there is no sharp line of demarcation between the instinct of the animal and the organizing work of living matter (Bergson, *Creative Evolution*, 147).

43. As already claimed by Ruyer, “Instinct, consciousness, life,” 144.

44. See Giorgio Prodi, “Material Bases of Signification.” *Semiotica* 69:3/4 (1988), 191-241.

45. See Maria Bukhvalova, “Partitioning of Acoustic Transmission Channels in Grasshopper Communities”. *Insects Sounds and Communication: Physiology, Behaviour, Ecology and Evolution*. Eds. Sakis Drosopoulos, Michael F. Claridge. Boca Raton: Taylor & Francis, 2006, 199-205.

46. Robert K. Vander Meer, Michael D. Breed, Karl E. Espelie, Mark L. Winston (eds), *Pheromone Communication in Social Insects: Ants, Wasps, Bees, and Termites*. New York/Milton Park: Routledge, 1998. Pheromones and kairomones form aerial or terrestrial spaces between the individuals: the space of a living being is always qualitative.

47. A synthesis of Phillip S. Callahan’s seminal work in this field can be found in “Electromagnetic communication and olfaction in insects.” *The Free Library*. 2004, Temple University - of the Commonwealth System of Higher Education, through its Center for Frontier Sciences 26 Jul. 2021 (<https://www.thefreelibrary.com/Electromagnetic+communication+and+olfaction+in+insects.-a0163395921>). For the phenomenon of bioelectrodynamics in general, see Mae-Wan Ho, Fritz-Albert Popp, Ulrich Warnke (eds), *Bioelectrodynamics and Biocommunication*. Singapore: World Scientific, 1994.

48. It is the famous thesis by Roger Caillois, “Mimicry and Legendary Psychastenia.” Trans. by John Shepley. *October*, 31, Winter 1984, 27. Caillois himself draws on the hypothesis of a “sympathetic magic” (25).

49. See Manuel Delanda, “Material Complexity.” *Digital Tectonics*. Eds. Neil Leach, David Turnbull, Chris Williams. London: Wiley, 2004, 14-22; Neil Leach, “Matter Matters: A Philosophical Preface.” *Active Matter*. Ed. Skylar Tibbits. Cambridge (Mass.): MIT Press, 2017, 22. On swarms, see also Jussi Parikka, *Insect Media: An Archeology of Animals and Technology*. Minneapolis/London: University of Minnesota Press, 2010.