

Topology and ontogenesis

Translation of a short section of Gilbert Simondon, *L'Individu et sa genèse physico-biologique* (Grenoble: Millon, 1995). The passage runs from 222-227; I indicate page breaks in brackets.

For the most part, this is a fairly literal translation, but I have opted for a few English idioms for the sake of readability. In that spirit, I have kept the original punctuation, which results in very long sentences, but I have inserted paragraph breaks for readability. I mark these inserted breaks with this sign [¶]; unmarked breaks are in the original. In addition to providing the French for difficult translations, I also interpolate a few English words for readability. Translator's notes appear as endnotes.

Draft of 19 July 2010. This translation is provided for academic use (personal study and classroom use) only; it is not for commercial purposes, nor for citation in any publication. A translation of Simondon's *L'Individu* is forthcoming from University of Minnesota Press (by another translator, not me). Think of this as just a taste of the excellent philosophy of Simondon and hence an encouragement to buy the translation when it appears.

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5. Topology and ontogenesis

Up until now, the problem of the relation of inert matter and life has above all been centered on the problem of the fabrication of living matter from [223] inert matter: it is in the chemical composition of living substances that the properties of life have been placed; since the synthesis of urea, numerous synthetic bodies have been elaborated; these are not solely rather small molecular bodies, which come from catabolic transformations, but bodies directly participating in anabolic functions that chemical synthesis can produce. However, a hiatus remains between the production of substances utilized by life and the production of the living being [*le vivant*]: it would be necessary to exhibit [*produire*] the topology of the living being, its particular type of space, the relation between a milieu of interiority and a milieu of exteriority, in order to approach life. The bodies of organic chemistry do not carry with them a topology different from that of physical relations and habitual energies. However, the topological condition is perhaps primary [*primordiale*] in the living being qua living. Nothing proves that we can adequately think the living being by means of Euclidean relations. The space of the living being is perhaps not a Euclidean space; the living being can be considered in a Euclidean space, where it is defined as a

body among bodies; even the structure of the living being can be described in Euclidean terms. But nothing proves that this description is adequate. If there were a set of topological configurations necessary for life, untranslatable in Euclidean terms, one would have to consider as insufficient any attempt to make a living being with matter worked up by organic chemistry; the essence of the living being is perhaps a certain topological arrangement that cannot be known on the basis of physics and chemistry, which utilize in general a Euclidean space.

Currently we are limited to conjectures in this domain. It is however interesting to realize that the properties of living matter manifest themselves as the maintenance [*le maintien*], the self-maintaining [*l'auto-entretien*] of certain topological conditions much more so than purely energetic or structural conditions. Thus, one of the properties that are found at the base of all [vital] functions, be they the conduction of nervous impulses, muscular contraction, or assimilation, is the polarized, asymmetrical, character of cellular permeability. The living membrane, [whether it be] anatomically differentiated or only [considered as a] functional [one] when no particular formation materializes the limit, is characterized as that which separates a region of interiority from a region of exteriority: the membrane is polarized, letting pass one kind of body [*tel corps*] in a centripetal or centrifugal direction, opposing the passage of another kind of body [*un tel autre*].

[¶] Without a doubt, one can find the mechanism of this one-way [*à sens unique*] permeability for definite types of chemical substance; for instance, the mechanism for the command of muscles by the intermediary of the motor plate [*plaque motrice*] has been explained by the release of acetylcholine, which momentarily destroys the potential of the polarized membrane; but this only serves to push the problem back, for the membrane is living precisely in the sense that it always re-polarizes itself, as if there were, in the expression of Gellhorn, a “sodium and potassium pump” which recreates the polarization of the membrane after the [completion of the vital] function; an inert membrane would be very rapidly brought to a neutral state by its functioning as a selective membrane; on the contrary, the living membrane conserves this property [of polarization]; it regenerates the asymmetrical character of its existence and its functioning. You could say that the living substance which is on the interior of the membrane regenerates the membrane, but it's the membrane that makes the living being alive at each moment, because this membrane is selective: it maintains the milieu of interiority [*milieu d'intériorité*] as a milieu of interiority in relation to [224] the milieu of exteriority [*milieu d'extériorité*]. You could say that the living being lives at its own limit [*à la limite de lui-même*], on its limit [*sur sa limite*]; it's in relation to this limit that there is a direction toward the inside and a direction toward the outside, in a simple unicellular organism.

[¶] In a multicellular organism, the existence of the interior milieu [*milieu intérieur*] complicates the topology, in the sense that there are several levels [*étages*] of interiority and exteriority; thus an internal secretion gland pours the products of its activity into the blood or another organic liquid: in relation to this gland, the interior milieu of the general organism is in fact a milieu of exteriority. By the same token, the intestinal cavity is an exterior milieu for the assimilating cells

which assure selective absorption along the length of the intestinal tract. According to the topology of the living organism, the interior of the intestine is in fact exterior to the organism, even though it accomplishes in this space a certain number of transformations conditioned and controlled by organic functions; this space is an annexed exteriority; thus if the contents of the stomach or intestine is noxious for the organism, the coordinated movements that direct the expulsion finish by emptying these cavities and rejecting into the completely (independently) exterior space the noxious substances which were previously in the exterior space annexed to the interiority. Similarly, the progress of the alimentary bolus is directed by different successive degrees of biochemical work on the bolus, controlled by internal perceptive units [*intérocepteurs*] which are in fact sense organs which it would be better to call medial perceptive units [*médiocepteurs*], for they capture information relative to the annexed exterior space and not to a true interiority.

[¶] We thus find diverse levels [*niveaux*] of interiority in the organism; the space of the digestive cavities is exterior in relation to the blood which irrigates the intestinal areas; but the blood is in turn a milieu of exteriority in relation to internal secretion glands which pour the products of their activity into the blood. You could thus say that the structure of a complex organism is not solely that of integration and differentiation; it is also this instauration of a transductive mediation of interiorities and exteriorities going from an absolute interiority to an absolute exteriority across different mediating levels of relative interiority and exteriority; we can classify organisms according to the number of mediations of interiority and exteriority that they put to work in order to accomplish their functions.

[¶] The simplest organism, which we can call “elementary,” is that which does not possess a medial interior milieu, but only an absolute interior and exterior. For this organism, the characteristic polarity of life is at the level of the membrane; it’s in this region [*à cet endroit*] that life exists in an essential manner as an aspect of a dynamic topology which itself maintains the metastability by which it exists. Life is self-maintenance [*auto-entretien*] of a metastability, but a metastability that requires a topological condition: structure and function are linked, for the most primitive and profound vital structure is topological.

[¶] It is only in complex organisms that the structure of integration and differentiation appears, with the appearance of the nervous system and the distinction between sense organs, effectors, and nervous centers; this non-topological structure of integration and differentiation appears as a means of mediation and organization that serves to sustain and extend the primary structure, which remains not only underneath but fundamental. We cannot therefore grasp the structure of the organism when we begin from the complex organismic unity of evolved organisms [*l’unité organismique des ensembles complexes d’organismes évolués*], for we risk privileging the organization of integration and differentiation. Furthermore, by following an atomist method, we cannot account for the true structure of the living being by considering the cells which [225] compose a complex organism as the architectonic units of this organism.

[¶] The totalizing vision and the elementary vision are both equally inadequate; we must begin with the base function, which relies upon the primary topological structure of interiority and exteriority, then we must see how this function is mediated by a chain of intermediary interiorities and exteriorities. At both ends of the chain, there is still the absolute interior and exterior; the functions of integration and differentiation are in the function of metastable asymmetry between absolute interiority and exteriority. This is why living individuation must be thought by topological schemas.

[¶] Moreover, the topological structures are those by means of which the spatial problems of the evolving organism can be resolved: thus, the development of the neo-pallium in superior species is essentially accomplished by the folding of the cortex: it's a topological, not a Euclidean, solution. We thereby understand why the homunculus is only a very approximate representation of the region [*des aires*] of cortical projection: the projection converts in fact a Euclidean space into a topological space, such that the cortex cannot be adequately represented in a Euclidean fashion. Rigorously speaking, we must not speak of projection with regard to the cortex, even if there is, in the geometrical sense of the term, projection for small regions; we would have to say: [there is a] conversion of Euclidean space into topological space. The basic functional structures are topological; the corporeal schema converts these topological structures into Euclidean structures by means of a medial system of relations which is the very dimensionality of the corporeal schema.ⁱ

If living individuation is a process which essentially unrolls according to topological structurations, we can understand why the limit cases between inert matter and the living being are precisely cases of a process which unrolls according to the dimensions of exteriority and interiority. Such is the case in the individuation of crystals. The difference between the living being and the inert crystal consists in the fact that the interior space of the inert crystal does not sustain the prolongation of the individuation which is effectuated at the limits of the crystal in the tracks of its growth [*en voie d'accroissement*]: interiority and exteriority only exist from one molecular layer to the next [*de couche moléculaire à couche moléculaire*], from a molecular layer already laid down to the layer in the process of being laid down [*en train de se déposer*]; a crystal can be emptied of an important part of its substance without stopping its growth; the interior is not homeostatic in its entirety in relation to the exterior, or, more exactly, in relation to the limit of polarity; in order for the crystal to be individuated it's necessary for it to continue to grow; this individuation is flake-like [*pelliculaire*]; the past doesn't serve any purpose [*ne sert à rien*] in its mass; it only plays the brute role of a support, it doesn't carry the availability of a informational signal [*la disponibilité d'un signal d'information*]: the successive time is not condensed.

[¶] On the contrary, in the living individual the space of interiority with its content plays in its entirety a role in the perpetuation of the individuation; there is resonance and there can be resonance because that which has been produced by individuation in the past takes part in the content of interior space: all the content of the interior space is topologically in contact with the

content of the exterior space at [*sur*] the limits of the living being; there is in effect no distance in topology; the entire mass of living matter which is in the interior space is actively present to the exterior world at the limit of the living being: all the products of the past of the individuation [*de l'individuation passée*] are present without distance and without delay. The fact of taking part in the milieu of interiority does not solely signify “being within” in the Euclidean sense, but it means being on the interior side of the limit without delay of functional efficacy, without [226] isolation, without inertia.

[¶] The living being does not interiorize solely in assimilating; it condenses and renders presents [*présente* used here as a verb] that which has been worked up in the succession: this function of individuation is spatio-temporal; we would have to define, over and above a topology of the living being, a chronology of the living being associated with this topology, just as elementary as it and as different from the physical form of time [or “the form of time in physics”: *la forme physique du temps*] as topology is different from the structure of Euclidean space.

[¶] In the same way that distances do not exist in topology, there is no quantity of time in chronology. This does not at all mean that the time of individuation is continuous, as Bergson affirms; continuity is one of the possible chronological schemas, but it is not the only one; schemas of discontinuity, contiguity, envelopment, can be defined in chronology as in topology. While Euclidean space and physical time cannot coincide, the schemas of chronology and topology are applicable one to the other; they are not distinct, and form the first dimensionality of the living being: each topological character has a chronological correlate, and the same holds inversely; thus for the living substance, the fact of being on the interior of the selective polarized membrane means that this substance has been taken into [*a été prise dans*] the condensed past. The fact that a substance is in the milieu of exteriority means that that substance can come forth [*peut advenir*], be proposed for assimilation, [or] wound [*léser*] the living individual: the substance is to come, is futural [*est à venir*].

[¶] At the level of the polarized membrane, the interior past and the exterior future face one another [*s'affrontent*]: this face off [*affrontement*] in the operation of selective assimilation is the present of the living being [*le présent du vivant*], which is made up of this polarity of passage and refusal, between substances which pass into the past [*substances passées*] and substances which come forth futurally [*adviennent*], [substances which are] present [*présentes* used here as an adjective] one to the other by means of [*à travers*] the operation of individuation; the present is that metastability of the relation between interior and exterior, past and future; it's in relation to this allagmaticⁱⁱ activity of mutual presence that the exterior is exterior and the interior is interior.

[¶] Topology and chronology coincide in the individuation of the living being. It is only afterward [*ultérieurement*] and according to psychic and collective individuations that the coincidence can be broken. Topology and chronology are not a priori forms of sensibility, but the

very dimensionality of the living being as it is being individuated [or “as it individuates itself”: *la dimensionnalité du vivant s’individuant*].

We therefore need a word to designate this dimensionality which is at first unique and which later is doubled in separate temporal and spatial dimensionalities. If not only this word, but also the set of unified representations that allow it to be given a precise sense, were to exist, it would perhaps be possible to think morphogenesis, to interpret the signification of forms, and to understand this premier relation of the living being to the universe and to other living beings, [a relation] which cannot be understood following either the laws of the physical world or the structures of elaborated psychisms; before even sensori-motor structures, there must exist chronological and topological structures, the universe of tropisms, tendencies, and instincts; the psychology of expression, still too detached and arbitrary even though founded in its own research domain, would find perhaps a means of axiomatization in a similar topological and chronological research program.

Moreover, a research program of this kind would perhaps allow us to understand why there are intermediary processes between the inert and animate worlds, such as the formation of crystallizable filtering viruses, for example, those of the tobacco mosaic. In the sap of the plant, this virus develops as a living being: it assimilates, since if one inoculates a certain quantity of the virus in a tobacco plant, the quantity of virus rises; in extracting the sap of the [227] plant, then in crystallizing the virus, one obtains a greater quantity of the crystallizable virus. However, when the virus is crystallized, nothing lets us say that it is living: it is no more living than hemoglobin or chlorophyll. If you were to find chemical bodies capable of assimilating to the state of a solution, without need of a crystalline germ in a supersaturated or surfused solution, a portion of the gap that separates living processes from physico-chemical processes would be filled in. The case of filtering viruses seems indeed to be intermediary between the two orders of processes; however, we need to remember that the tobacco mosaic only assimilates in a living milieu; it might thus be the potentials of the living plant which are utilized by the virus, a virus which would thus not truly be living, if its assimilating activity is in reality a borrowed activity, sustained and fed by the activity of the plant.

[¶] Up until now, the problem has not been resolved: you can only say that without a doubt this problem must be considered as implying an axiomatic formation along the lines of [*selon*] chronology and topology, and not simply along those of physics and chemistry [*la connaissance physico-chimique*]. The study of elementary functions does not imply atomism. It is regrettable that the holistic systematicity of biologism, such as it is represented by Goldstein, is conceived as necessarily macrophysical, [insofar as it] latches on to [*prise sur*] the totality of the complex organism. The Parmenidean ontology of Goldstein prevents any relation between the study of the living thing and the study of the inert [domain], whose processes are microphysical.

[¶] There might be an intermediary order of phenomena, between parcellary microphysics and the macrophysical unity of the organism [*l’unité organismique macrophysique*]; this order would

be that of genetic processes,ⁱⁱⁱ chronological and topological, that is to say, the processes of individuation, common to all orders of reality in which an ontogenesis operates: discovering an axiomatic of ontogenesis remains [an open task], if indeed such an axiomatic can be defined. It may be that ontogenesis is not axiomatizable, which would explain the existence of philosophical thought as perpetually marginal in relation to all the other fields of study, philosophical thought being that which is moved [*mue*] by the implicit or explicit research in ontogenesis in all orders of reality.

TRANSLATOR'S NOTES

ⁱ In *How the Body Shapes the Mind* (Oxford, 2004) Shaun Gallagher distinguishes the body image from the body schema. For Gallagher, the body image is representational (and hence “Euclidean” in Simondon’s sense), whereas the body schema is functional (and hence “topological” in Simondon’s sense). So Simondon’s *schéma corporel* would map onto Gallagher’s “body image” rather than onto “body schema” but I’m using a literal translation of “corporeal schema,” as one of Gallagher’s points is the historical fluidity of usage of these terms.

ⁱⁱ From the excellent resource on Simondon’s vocabulary [<http://fractalontology.wordpress.com/2007/11/28/a-short-list-of-gilbert-simondons-vocabulary/>], we find this definition: **Allagmatic** - The Greek word *allagma* can mean change or vicissitude, but it can also mean that which can be given or taken in exchange, which more genuinely captures the idea of energy exchange in Simondon’s usage....Simondon will also define the allagmatic as “the theory of operations” (*IGB*, 263), complementary to the theory of structures that the sciences elaborate. On the same page, Simondon will define an operation as “a conversion of a structure in another structure.”

ⁱⁱⁱ As the rest of the sentence makes clear, Simondon means “genetic” in the philosophical sense of “generative,” rather than the molecular biological sense of DNA, RNA, protein synthesis, etc.