

Topology, chronology, and order of magnitude of physical individuation

Translation of a short section of Gilbert Simondon, *L'Individu et sa genèse physico-biologique* (Grenoble: Millon, 1995). The passage runs from 146-151; 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. Simondon's notes appear as footnotes; translator's notes 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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4. Topology, chronology, and order of magnitude of physical individuation

If, on the other hand, we directly envision microphysical reality, an interpretation of individuation starting from phenomena of structural change would focus on considering becoming as essentially tied to operations of individuation which are accomplished in successive transformations; determinism would remain applicable as the limit-case when the system under consideration is not the theater of any individuation, that is, when no exchange, modifying the structures of the system, is accomplished between structure and energy, leaving it topologically identical to that which it was in its previous states; on the other hand, indeterminism would appear as a limit-case when a complete structural change appears in a system, with the transition from one order of magnitude to another; this is the case, for example, of modifications brought to a system by the fission of an atomic nucleus: intranuclear energies, belonging until then to the internal system of that nucleus, are liberated by fission, and can act in the form of a gamma photon or a neutron on the bodies belonging to a system situated at a higher level [*échelon*] than that of the atomic nucleus.

[¶] Nothing in a macroscopic system allows us to foresee at which instant of macroscopic time a fission will take place [*se situera*], which would liberate an energy that will be efficacious at the macroscopic level. Indeterminism is not only tied to measure; it also comes from the fact that physical reality has [*comporte*] topologically imbricated layers [*échelons*] of magnitude [*grandeur*], which nonetheless each has its own becoming, its particular chronology.

Indeterminism would exist in a pure state if there were no correlation between the topology and the chronology of physical systems. This absence of correlation is never absolutely complete; it's only abstractly that one can speak of an absolute indeterminism (realizable by a complete internal resonance) or of an absolute determinism (realizable by a complete independence between chronology and topology).

[¶] The general case is that of a certain level [*niveau*] of correlation between the chronology and topology of a system, a level [*niveau*] that is moreover variable in function of the vicissitudes of its own becoming; a system reacts on itself not only in the sense of the principle of entropy, by the general law of its internal energetic transformations, but also in modifying its own structure across time. The becoming of a system is the manner in which it individuates itself [*la manière dont il s'individue*], that is, essentially the manner in which it conditions its very self [*il se conditionne lui-même*] according to [*selon*] the different structures and successive operations by which it reverberates in itself and passes out of phase with itself [*se déphase*] in relation to its initial state.

[¶] Determinism and indeterminism are only limit-cases, because there is a becoming of systems: this becoming is that of their individuation; there exists a reactivity of systems in relation to themselves. The evolution of a system would be determined if the system had no internal resonance, that is, no exchange between different levels [*échelons*] which it encloses and which constitute it; no quantitative change of structure would be possible, and one could know the becoming of the system [147] by the theory of continuity, that is, according to the law of great numbers, as thermodynamics does. Pure indeterminism would correspond to an internal resonance so elevated that any modification occurring to a specific level [*échelon déterminé*] would immediately have repercussions [*retentirait*] on all the levels in the form of a change of structure.

[¶] In fact, the general case is that of quantitative thresholds of resonance: in order that a modification being produced at one level [*niveau*] attain the other levels, it's necessary that it be superior to a certain value; internal resonance is only accomplished in a discontinuous manner and with a certain delay from one level [*échelon*] to the other; the physical individuated being is not totally simultaneous in relation to itself. Its topology and chronology are separated by a certain gap [*écart*], variable according to the becoming of the individuated grouping [*ensemble*]ⁱ; a substance [in the philosophical sense] would be a physical individual totally resonant in relation to itself, and consequently totally identical to itself, perfectly coherent with itself, one [with itself]. A physical being, on the contrary, must be considered as more than a unity and more than an identity, [as] rich in potentials; the individual is in the tracks of individuation [*en*

voie d'individuation] starting from a pre-individual reality which subtends it; the perfect individual, totally individuated, substantial, impoverished and emptied of its potentials, is an abstraction; the individual is in the tracks of ontogenetic becoming, it has a relative coherence in relation to itself, a relative unity and a relative identity. The physical individual must be considered as a chrono-topological grouping [*ensemble*] whose complex becoming is made up of [*fait de*] successive crises of individuation; the becoming of the being consists in this non-coincidence of chronology and topology. The individuation of a physical grouping [*ensemble*] would thus be constituted by the linking together [*l'enchaînement*] of successive regimes of that grouping [*ensemble*].

Such a conception would thus consider energetic regimes and structural states as convertible across the becoming of a grouping [*le devenir d'un ensemble*]; thanks to the notion of orders of magnitude and to the notion of threshold in exchanges, this conception would affirm that individuation exists between the purely continuous [*le continu pur*] and the purely discontinuous; the notion of threshold and of quantitative exchange is, in effect, a mediation between the purely continuous and the purely discontinuous. It would introduce [*ferait intervenir*] the notion of information as a fundamental character of individuation conceived according to [*selon*] dimensions that would be at once chronological and topological. One could thus speak of a more or less elevated level [*niveau*] of individuation: a grouping would possess a level [*niveau*] of individuation more elevated insofar as it would enclose and render compatible [*comptabiliserait*] in its chronological and topological system [*systématique*] more of the given pre-individual reality, or yet again [*encore*] orders of magnitude more distant from each other.

Such a hypothesis supposes that there is no elementary individual, no primary individual anterior to any genesis; there is an individuation in a grouping; the primary reality is pre-individual, richer than the individual understood as the result of individuation; the pre-individual is the source of chronological and topological dimensionality. The oppositions between the continuous and the discontinuous, between particle and energy, would thus express not so much complementary aspects of the real as dimension which surge forth in the real when it individuates itself [*les dimensions qui surgissent dans le réel lorsqu'il s'individue*]; the complementarity at the level [*niveau*] of individuated reality would be the translation of the fact that individuation appears on the one hand as ontogenesis and on the other hand as the operation of a pre-individual reality which does not only give the individual as model of substance, but also [*gives*] the energy or the field associated with the individual; only the couple [*composed of*] the individual and the associated field accounts for the level [*niveau*] of pre-individual reality.

It is this presupposition of the pre-individual character of primary reality which otherwise permits the consideration of the physical individual as being in fact a grouping; [148] the individual corresponds to a certain dimensionality of the real, that is, to an associated topology and chronology; the individual is an edifice in its most current form [*sous sa forme la plus courante*], that is, in the form in which it appears to us, [*as*] crystal or molecule. As such, it is not an absolute [*reality*], but a reality which corresponds to a certain state of equilibrium, generally

metastable, founded on a regime of exchanges between different orders of magnitude which can be modified either by an internal becoming or by an external event carrying a certain new condition to the internal regime (for example, an energetic condition, as when a neutron coming from a fissioning nucleus provokes the fission of another nucleus). There is thus a certain consistency [*consistance*] of the individual, but not an absolute antitype, an impenetrability having a substantialist sense [*un sens substantiel*]. The consistency of the individual edifice is yet again [*encore*] founded on quantitative conditions; it depends on thresholds.

The limits of the physical individual are also themselves metastable; a grouping of fissionable nuclei is not a really individuated grouping if the number of nuclei, taking into account the average radioactivity of the nuclei, is small enough that the fission of a nucleus has little chance of provoking the fission of another nucleus¹; everything happens as if each nucleus were isolated from the others; each one having its own chronology and fission occurring to [*advient pour*] each nucleus as if it were alone; on the other hand, if a great quantity of fissionable matter were to be gathered, the probability that the results of the fission of any one nucleus would provoke the fission of at least one other rises: when this probability reaches 1.0, the internal chronology of each nucleus changes abruptly; instead of being independent [*consister en elle-même*], it forms an internal resonance network with those of all the other fissionable nuclei: the physical individual is thus the entire mass of fissionable matter, and no longer each nucleus; the notion of critical mass provides an example of what we can call a relative threshold of individuation: the chronology of the grouping abruptly becomes coextensive with the topology of the grouping: there is an individuation because there is an exchange between the microphysical and the macrophysical level; the capacity for the reception of information of the grouping rises abruptly. It's in modifying the topological conditions that one can utilize nuclear energy either for sudden and harsh effects [*effets brusques*] (by bringing together several masses, each one inferior to the critical mass) or for continuous moderated effects (by controlling the exchange between fissionable nuclei by means of a controllable apparatus [*dispositif réglable*] which maintains the grouping below the unitary coefficient of amplification, for example by the greater or lesser absorption of the radiation). Consequently, we can say that the degree of individuation of a grouping depends on the correlation between the chronology and topology of the system; the degree of individuation can also be called the level [*niveau*] of interactive communication, since it defines the degree of internal resonance of the grouping.²

From this point of view, it seems possible to understand why the antagonistic representations of the continuous and the discontinuous, of matter and energy, of structure and operation, are not

¹ In this case, the communication between orders of magnitude (i.e., between each nucleus and the total population of nuclei) is insufficient.

² In a similar demonstration [*montage*], we can say that an individuation is produced at the moment that the system can *diverge*, that is, when the system is capable of receiving information. [Italics in original.]

utilizable other than in the form of complementary couples; it's because these notions define the opposed and extreme aspects [149] of orders of reality between which individuation is instituted; but the operation of individuation is the active center of this relation; it is this operation which is the unity that self-duplicates [*l'unité se dédoublant*] into the aspects which are for us complementary while in the real they are coupled by the continuous and transductive unity of the intermediary being, which we are naming here "internal resonance"; the complementary aspects of the real are those extreme aspects defining the dimensionality of the real. As we can only apprehend reality by its manifestations, that is, while it changes, we only perceive the extreme complementary aspects; but these are dimensions of the real rather than the perceived real; we grasp its chronology and its topology of individuation without being able to seize the pre-individual real which subtends this transformation.

Information, understand as the arrival of a singularity creating a communication between orders of reality, is that which we can the most easily think, at least in certain particular cases such as chain reactions, free or limited. This intervention of a notion of information does not however permit us to resolve the problem of the relation of different levels of individuation. A crystal is composed of molecules; for a supersaturated solution to crystallize, the reunion of energetic conditions (metastability) and structural conditions (the crystalline germ) is necessary; can an individuated being such as a molecule, which is already an edifice, intervene as the structural germ of the larger edifice that is a crystal? – Or indeed is a structural germ which is already of an order of magnitude greater than that of a molecule necessary for crystallization to begin? It is difficult, given our present state of knowledge, to provide a generalizable answer to this question.

[¶] We can only say that the problem of the relations between inert matter and life would be more clear if one could show that the living being is characterized by the fact that it discovers in its own field of reality the structural conditions permitting it to resolve its own incompatibilities, the distance between the orders of magnitude of its reality, while inert matter does not have this power of structural autogenesis; a singularity is necessary for a supersaturated solution to crystallize; does this mean that inert matter does not augment its endowment [*son capital*] of singularities, while living matter augments this endowment, this augmentation being precisely the ontogenesis of the living being, capable of adaptation and invention? One can only give this distinction the title of a methodological hypothesis; it doesn't seem that we must oppose living matter and non-living matter, but rather [we must oppose] a primary individuation in inert systems and a secondary individuation in living systems, precisely along the lines [*selon*] of the different modalities of regimes of communication in the course of these individuations; there would thus be, between the inert and the living, a quantitative difference of capacity to receive information rather than a substantial difference; the continuity, if it exists, between the inert and the living should be looked for at the level [*niveau*] which is situated between microphysical and macrophysical reality, that is, at the level [*niveau*] of the individuation of systems such as the large molecules of organic chemistry, [which are] complex enough that variable regimes of the

reception of information can exist there, and restrained enough in dimensions that the microphysical forces intervene there as carriers of energetic and structural conditions.

Along the lines of this conception, we can say that the bifurcation between the living [*vivant*] and the non-living is found at a certain dimensional level, that of macromolecules: phenomena of an inferior order of magnitude, which one calls microphysical, are in fact neither physical nor vital, but pre-physical and pre-vital; the purely physical [150], non-living, begins only at the supra-molecular level [*échelon*]; it's at this level [*niveau*] that individuation gives a crystal or the mass of protoplasmic matter.

In macrophysical forms of individuation, we clearly distinguish the living [*vivant*] from the non-living; while an organism assimilates in self-diversifying, a crystal grows by the iteration of an adjunction of ordered layers [*couches*], indefinitely numbered. But at the level [*niveau*] of macromolecules, we can hardly say if a filtering virus is living or non-living. Adopting the notion of the reception of information as the essential expression of the operation of individuation would be to affirm that individuation operates at a certain (topological and chronological) dimensional level [*échelon*]; below this level [*échelon*], reality is pre-physical and pre-vital, because pre-individual.

[¶] Above this level [*échelon*], there is a *physical* individuation when the system is capable of receiving information only once, then develops and amplifies this initial singularity in individuating itself in a manner that is not self-limited [*non autolimitée*]. If the system is capable of successively receiving several deliveries [*apports*] of information, [capable] of rendering compatible several singularities, instead of iterating them in a cumulative fashion [*par effet cumulatif*] and by a transductive amplification of the unique and initial singularity, the individuation is of the vital type, self-limited, organized.

It is habitual to see in vital processes a greater complexity than in non-vital, physico-chemical, processes. However, to be faithful, even in the most hypothetical conjectures, to the intention animating this research, we should suppose that vital individuation does not come *after* physico-chemical individuation, but during this individuation, before its completion, by suspending it at the moment when it has not attained its stable equilibrium, and by rendering it capable of extending itself and propagating itself before the iteration of a perfect structure capable only of repeating itself, [all these actions being] that which conserves in the living individual something of the pre-individual tension, of the active communication, in the form of internal resonance, between the extreme orders of magnitude.

In this manner of seeing things, vital individuation would come to insert itself in physical individuation in suspending its course, in slowing it down, in rendering it capable of propagation in an inchoate state. The living individual would be in some manner, at its most primitive levels [*niveaux*], a crystal in the state of being born [*à l'état naissant*], amplifying itself without stabilizing itself.

To bring this interpretive schema into line with more current notions, we can appeal to the notion of neoteny, and generalize this type of relation between classes of individuals, in supposing, in the category of living beings [*des vivants*], a cascade of possible neotenic developments. Animal individuation can, in a certain sense, be considered as more complex than vegetative individuation. However, one can also consider the animal as an inchoate plant [*un végétal inchoatif*], developing and organizing itself by conserving the motile, receptive, and reactive possibilities which appear in the reproduction of vegetative life [*la reproduction des végétaux*]. If we suppose that vital individuation retains and dilates the most precocious phase of physical individuation – such that the vital would be the physical in suspense, slowed down in its process and indefinitely dilated – we can also suppose that animal individuation feeds on [*s'alimente*] the most primitive phase of vegetative individuation, retaining in itself something anterior to the development of the adult plant [*végétal adulte*], and in particular maintaining, during a longer time, the capacity of receiving information.

We would thus understand why the categories of more and more complex individuals, but also more and more incomplete ones, less and less stable and self-sufficient, have need of, as an associated milieu, layers [*couches*] of more complete and more stable individuals. [151]. Living beings need physico-chemical individuals to live; animals need plants [*végétaux*], which are for them, in the proper sense of the term, “nature,” as are chemical compounds for plants.

TRANSLATOR'S NOTES

ⁱ *Ensemble* is often understood as oriented to harmony, to a unified totality, that is, as not just a group, but a group that works well together, that expresses an underlying principle. This cannot be Simondon's sense, as the text makes clear; for him, a physical being, qua *ensemble*, is more than a unity. So I've adopted "grouping" as a neutral term for a collectivity that is not oriented to a unity derived from a principle. There's an echo of this in modern set theory [*théorie des ensembles*], which adopts an extensionalist stance: sets or *ensembles* are simple collections; they can be enumerated only by listing; they are not unified by a concept.